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THE HABITAT TYPES OF REGION II

U.S. FOREST SERVICE:

A SYNTHESIS

C. H. Wasser

Karl Hess

Final Report For:

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The Authors

C. H. Wasser, currently a private natural resource consultant and formerly Professor of Range Ecology, retired in 1981 after a lengthy teaching, research, and administration career at Colorado State University. He taught a variety of Range Management and Ecology subjects and was concerned with many researches in grassland and alpine ecology including testing of plants for revegetating rangeland and disturbed lands. Academic training was received at the University of Arizona, University of Nebraska, and Colorado A&M College. Specialized training was later pursued at the University of Minnesota, Texas A&M University, University of Georgia, and University of California at Davis.

Karl Hess, currently a Research Associate with the Oregon State University Rangeland Resources Department and stationed in Kairouan, Tunisia, formerly was associated for several years with research efforts to develop a habitat type classification for the National Forests in Colorado. He obtained his B.A. and M.A. degrees from the University of Virginia and the Ph.D. degree in Range Science from Colorado State University. Much of the classification contained in this manuscript is a synthesis and abstracting of his earlier researches in the Arapaho-Roosevelt and White River National Forests.

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INTRODUCTION

The widespread acceptance and implementation of the classification methodology of habitat typing within the U. S. Forest Service has been associated with a concurrent distortion and dilution of the essence of the habitat type concept. Many scientists and land managers both within and outside of the U. S. Forest Service have perpetuated a misconception of the habitat type that invalidates most national forest habitat type classifications and severely jeopardizes the successful application of land management techniques based on those classification schemes. The source of misunderstanding lies in the near universal tendency to equate a habitat type with a plant association (plant association is defined as the climax community type within a polyclimax framework). The extent to which this misconception is held by Forest Service personnel is evident in the frequent references, both written and oral, to the equivalence between the habitat type and the plant association. The effect of this widely held opinion has been to 1) perpetuate a major misunderstanding of the nature of the habitat type and of habitat type classification and 2) to obscure the ecosystem origins of the habitat type and the ecological information that is contained within it.

Although the habitat type idea originated in the writings of Rexford Daubenmire, its intellectual source is traceable directly to the ecosystem formulations presented years earlier by A. G. Tansley (1935). Incorporating the ecosystem framework established by Tansley, Daubenmire pioneered a new method of natural resource classification dependent upon the distinction

"between vegetation and the area it occupies." This area which one plant association occupies, or will come to occupy as succession advances, was termed the habitat type by Daubenmire (1952). Daubenmire reiterated the distinction between a habitat type and a plant association in two subsequent studies of forest and steppe vegetation in Washington and northern Idaho (Daubenmire and Daubenmire, 1968; Daubenmire, 1970). In each of these studies, Daubenmire portrayed the habitat type as an unique spatial unit exhibiting a specific range of abiotic and biotic parameters -- in otherwords, a fundamental ecosystem unit comprised not only of a plant association but of a soil system and an associated above-ground atmospheric and physiographic space within which fauna and flora components existed.

A habitat type is, therefore, best described as the collective embodiment of all landscape areas that now support, have supported or which are presumably capable of supporting the same plant association. As such, a habitat type is not a plant association. It is a physical and biological system whose parameters encompass all interacting biotic and abiotic elements within the delineated space of the habitat type. More importantly, the habitat type is not a system of vegetation classification. Indeed, the fact that any particular habitat type can support numerous community types other than the climax type undermines its utility as a purely vegetational classification scheme. The usefulness of the habitat type concept lies in its ability to provide the foundation for an ecologically sound system of landscape classification by combining into a single classificatory unit all land areas whose biotic nature is expressed by the same existing or potential plant association. By delineating landscape units on the basis of biotic similarities, habitat type classification provides a primary ecosystem categorization and ordering of an otherwise complex and highly diverse terrain. This delineation, in turn, permits scientists to apply experimental

methods to land areas of a pre-determined ecological character and allows land managers to develop ecosystem specific management plans.

The acceptance of the habitat type as an ecosystem unit and not as a plant association necessitates a re-evaluation of the current status of habitat type studies on western public lands. In particular, the conspicuous absence of habitat type studies in Region II reflects the present dilema of land classification on national forestlands and national grasslands. Numerous studies contending to be habitat type classifications have been published by the U. S. Forest Service in Region II. However, except for the habitat type classifications of the Arapaho-Roosevelt (Hess, 1981) and White River-Arapaho (Hess and Wasser, 1982) National Forests, the remaining studies have been merely compilations of plant associations -- all of which lack sufficient edaphic and environmental characterization for elevation to habitat type status. Consequently, the present report has as its primary purpose the assessment of the current status of habitat type classification in Region II; specifically, to provide a summarization and description of all habitat types within the national forests and national grasslands of Region II of the U. S. Forest Service which have either been confirmed directly by field studies or which are capable of confirmation through synthesis of various written sources.

The achievement of this goal requires adherence to the strictest definition of habitat type: a 3-dimensional space, hereafter referred to as an ecosystem, delineated above-ground by an existing or potential climax plant association, but including all abiotic and biotic elements of both the soil-root zone and the atmospheric-physiographic zone extending from the soil surface to and including the furthest regions occupied by plant materials and other associated living and non-living extensions of the habitat

space. Accordingly, the habitat type is not a unit of vegetation. It is the aggregate of all areas that support, or can support, the same primary vegetation and which delineate an environment of distinctive potentialities as to pristine and derived types of communities (Hess, 1981). As such, habitat type classification is treated as an ecological classification of landscape units and not as a scheme of plant community classification.

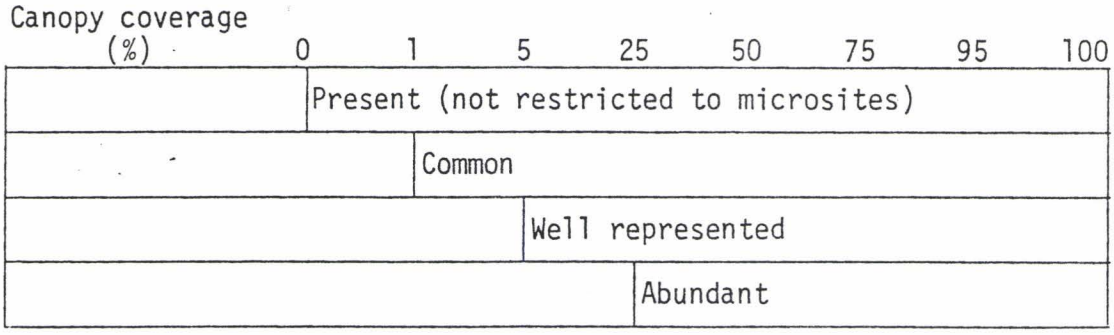
The habitat types of Region II that are described in this study are necessarily preliminary and unfortunately incomplete due not to the lack of vegetational information, but to the sparsity of edaphic and other environmental data. The sufficiency of vegetational data is evident in the U. S. Forest Service publication, *The Plant Associations of Region Two* (U.S.D.A., 1981); a refinement and continuation of a previous report by Terwilliger, Hess, and Wasser (1979). Although each habitat type described in this study has a corresponding plant association in that publication, very few of the numerous plant associations occuring within Region II have sufficient accompanying edaphic and environmental data to permit the formulation of supporting habitat types. Similarily, the habitat types presented in this study do not include "habitat types" previously described in Region II national forests and national grasslands which lack essential edaphic and environmental characterization. Such habitat types are considered plant associations and, as such, will be found in *The Plant Associations of Region Two*.

The presentation of each habitat type in the following pages follows a standard format. The plant association supported by a particular habitat type is described first, followed by a summarization of the general non-soil environmental parameters, and concluded by a brief description of soil characteristics and major soil families (when available) comprising the edaphic environment of the habitat type. A key to the habitat types of Region

II, based on vegetational and abiotic features, precedes the general description of the habitat types. Presentation of the habitat type descriptions, which are referenced by page number in the key, is based on the physiognomy of the occupying plant association; forestlands and woodlands are presented first, shrublands second, and grasslands and forblands third. Finally, each habitat type description includes a source reference, the entirety of which is presented in the bibliography which immediately follows the description of Region II habitat types, and a geographic location which is more precisely specified in the previously mentioned source reference.

KEY TO HABITAT TYPES OF REGION II
U.S. FOREST SERVICE

This key applies specifically to vegetation not severely altered from pristine conditions. Changes in community composition due to natural or man-related causes must be kept in mind when using this key. On severely altered sites, habitat types can be identified by observing and classifying adjacent remnant areas which are relatively free of disturbance and which exhibit similar environmental features. In particular, habitat type descriptions should be used in conjunction with the key to ensure accurate classification. Use of the definitions diagrammed below or canopy coverage terms will facilitate successful use of the key.



KEY TO THE MAJOR PHYSIOGNOMIC VEGETATION TYPES

1. Successfully reproducing woody plants conspicuous and well represented (generally over 15% canopy coverage) .....

    2. Continuous to open overstory of successfully reproducing trees dominate aspect...Forestlands/Woodlands.....(A)

    2. Trees absent or, if present, widely scattered and poorly represented; shrubs dominate aspect...Shrublands.....(B)

1. Successfully reproducing woody plants absent or poorly represented; shrubs absent, widely scattered, or present as half-shrubs such as *Artemisia frigida*; graminoids or forbs conspicuous and dominate aspect .....

    3. Graminoids conspicuous and dominate aspect; forbs present but less conspicuous seasonlong...Grasslands.....(C)

    3. Graminoids present but not dominant; forbs conspicuous and dominating vegetal aspect...Forblands.....(D)

A. KEY TO THE FORESTLAND/WOODLAND HABITAT TYPES

1. Coniferous trees present and dominant climax component; deciduous trees absent or, if present, not indicated climax 2

1. Coniferous trees absent or minor climax component; deciduous trees present and reproducing successfully 38

    2. *Pinus* spp. reproducing successfully and dominate aspect 3

    2. *Pinus* spp. absent, not common, or seral 21

3. *Pinus ponderosa* successfully reproducing dominant in old growth stands; other conifers may be well represented but are not dominating 4

3. *Pinus ponderosa* not well represented; other *Pinus* spp. successfully reproducing dominants 12

    4. *Juniperus* spp. or *Quercus* spp. well represented co-dominants or inferior layer dominants; shrubs or herbs may be present but less conspicuous 5

    4. Other mountain shrubs or grasses subdominants in the substrata; *Juniperus* spp. or *Quercus* spp. not well represented in climax 8

5. *Juniperus* spp. conspicuous codominants or lower layer dominants but not sole dominants; *Quercus* spp. absent or not well represented 6

5. *Quercus* spp. conspicuous climax codominants; not sole dominants; *Juniperus* spp. absent or not well represented 7

6. *Juniperus scopulorum*, a conspicuous codominant in old growth stands; *Cercocarpus montanus* present... *Pinus ponderosa-Juniperus scopulorum/cercocarpus montanus* h.t. p.22

6. *Juniperus communis* a conspicuous dominant of the undercover; other *Juniper* spp. not well represented... *Pinus ponderosa/Juniperus communis* h.t. p.25

7. *Quercus macrocarpa* codominant in tree canopy; *Prunus virginiana* a prominent subdominant...*Pinus ponderosa-Quercus macrocarpa/Prunus virginiana* h.t. p.26

Quercus gambelii a dominant in shrub canopy; *Carex geyeri* most prominent in undercover..*Pinus ponderosa/Quercus gambelii/Carex geyeri* h.t. p.27

8. Mountain shrubs other than *Juniperus* spp. and *Quercus* spp. dominant tree undercover; graminoids not well represented 9

8. Graminoids well represented in tree undercover; shrubs not well represented 10

9. *Symphoricarpos albus* conspicuous climax undercover component; other shrubs absent or poorly represented... *Pinus ponderosa/Symphoricarpos albus* h.t. p.24

9. *Purshia tridentata* conspicuous climax undercover component; other shrubs absent or poorly represented... *Pinus ponderosa/Purshia tridentata* h.t. p.23

9. *Cercocarpus montanus* conspicuous climax undercover component; other shrubs absent or poorly represented... *Pinus ponderosa/Cercocarpus montanus* h.t. p.21

10. *Carex rossii* most conspicuous undercover species... *Pinus ponderosa/Carex rossii* h.t. p.30

10. *Carex rossii* absent or poorly represented; grass species dominating tree undercover 11

11. *Hesperochloa kingii* well represented and principal graminoid...*Pinus ponderosa/Hesperochloa kingii* h.t. p.31

11. *Muhlenbergia montana* well represented and principal graminoid...*Pinus ponderosa/Muhlenbergia montana* h.t. p.29

11. *Andropogon scoparius* well represented and principal graminoid...*Pinus ponderosa/Andropogon scoparius* h.t. p.28

12. *Pinus contorta* a successful reproducing dominant in old growth stands; other *Pinus* spp. absent, poorly represented, or seral; understrata dominated by graminoids or shrubs 13

12. *Pinus contorta* absent, minor or seral; other *Pinus* spp. successful reproducing dominants in old growth stands 16

13. Graminoids dominate climax understrata; shrubs absent or poorly represented 14

13. Shrubs dominate climax understrata; graminoids absent or poorly represented 15

14. *Carex geyeri* conspicuous and principal graminoid in undercover; grasses may be present but less prominent... *Pinus contorta/Carex geyeri* h.t. p.44

14. *Poa nervosa* most conspicuous in undercover; *Carex* spp. less conspicuous if present...*Pinus contorta/ Poa nervosa* h.t. p.45

15. *Juniperus communis* conspicuous and primary understrata dominant...*Pinus contorta/Juniperus communis* h.t. p.41

15. *Shepherdia canadensis* conspicuous and primary undercover dominant...*Pinus contorta/Shepherdia canadensis* h.t. p.42

15. *Vaccinium scoparium* conspicuous and primary understory dominant...*Pinus contorta/Vaccinium scoparium* h.t. p.43

16. *Pinus edulis* a climax dominant; five-needled *Pinus* spp. absent or rare; *Juniperus* spp. and *Quercus* spp. may be conspicuous associates but not sole overstory dominants 17

16. Five-needled *Pinus* spp. (*P. flexilis, aristata, or albicaulis*) well represented overstory dominants; other conifers poorly represented if present 18

17. *Pinus edulis* and *Juniperus osteosperma* share canopy dominance; *Cercocarpus montanus* conspicuous...*Pinus edulis-Juniperus osteosperma/Cercocarpus montanus* h.t. p.65

17. *Pinus edulis* primary overstory dominant; *Quercus gambelii* and *Carex geyeri* well represented in understrata...*Pinus edulis/Quercus gambelii/Carex geyeri* h.t. p.66

18. *Pinus flexilis* conspicuous and primary overstory dominant; understrata dominated by shrub, forb, or graminoid species 19

18. *Pinus aristata* or *Pinus albicaulis* conspicuous and primary dominants in tree canopy; other tree species not conspicuous or very abundant 20

19. Tree understrata dominated by graminoids; shrubs and forbs less conspicuous if present...*Pinus flexilis/Calamagrostis purpurescens* h.t. p.46

19. Tree understrata dominated by evergreen shrubs; herbs present but less conspicuous...*Pinus flexilis/Juniperus communis* h.t. p.47

19. Tree understrata dominated by *Trifolium dasyphyllum* ...*Pinus flexilis/Trifolium dasyphyllum* h.t. p.48

20. *Pinus aristata* dominates canopy; *Trifolium dasyphyllum* most conspicuous in tree understrata...*Pinus aristata/Trifolium dasyphyllum* h.t. p.49

20. *Pinus albicaulis* dominant in tree canopy; *Vaccinium scoparium* most prominent in understrata vegetation... *Pinus albicaulis/Vaccinium scoparium* h.t. p.50

21. *Juniperus osteosperma* sole canopy dominant; *Juniperus scopulorum* absent or poorly represented; shrubs most conspicuous understory components...*Juniperus osteosperma/Cercocarpus montanus-Peraphyllum ramosissimum* h.t. p.61

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22. *Cercocarpus montanus* conspicuous primary understory dominant; other shrubs, if present, less abundant... *Juniperus scopulorum/Cercocarpus montanus* h.t. p.63

23. *Pseudotsuga menziesii* a conspicuous and successful reproducer in old age stands; *Picea* spp. and *Abies* spp. absent or poorly represented 24

23. *Picea* spp. and/or *Abies* spp. dominate canopy and successfully reproducing 28

24. Shrub species dominate tree undercover; graminoids present but less conspicuous or abundant 25

24. Graminoids dominate the tree understrata; shrubs less conspicuous if present 27

25. *Physocarpus monogynus* principal dominant in understory... *Pseudotsuga menziesii/Physocarpus monogynus* h.t. p.32

25. *Jamesia americana* dominates undercover...*Pseudotsuga menziesii/Jamesia americana* h.t. p.33

25. *Pachystima myrsinites* primary undercover dominant... *Pseudotsuga menziesii/Pachystima myrsinites* h.t. p.34

25. *Symphoricarpos oreophilus* principal dominant in understory; *Physocarpus* and *Jamesia* absent or poorly represented 26

26. *Carex geyeri* well represented in understrata... *Pseudotsuga menziesii/Symphoricarpos oreophilus/ Carex geyeri* h.t. p.35

26. *Carex geyeri* absent or minor understratal member... *Pseudotsuga manziisii/Symphoricarpos oreophilus* h.t. p.36

27. *Carex rossii* dominates tree understrata...*Pseudotsuga menziesii/Carex rossii* h.t. p.37

27. *Carex geyeri* the principal undercover dominant... *Pseudotsuga menziesii/Carex geyeri* h.t. p.38

28. *Picea* spp. dominates the canopy; *Abies* absent or secondary 29

dominant or

28. *Abies* spp./codominant with *Picea* spp. in canopy 32

29. *Picea pungens* dominates tree canopy 30

29. *Picea engelmannii* dominates the overstory 31

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33. Forbs dominate the undercover...(nonexistent or seral) .....

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37. *Vaccinium scoparium* principal understory dominant...*Picea engelmannii-Abies lasiocarpa/Vaccinium scoparium* (A) h.t. p.53

37. *Salix pseudolapponum* principal understory dominant...*Picea engelmannii-Abies lasiocarpa/Salix pseudolapponum* h.t. p.55

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42. *Ostrya virginiana* well represented; shrubs less conspicuous...*Populus tremuloides/Ostrya virginiana* h.t. . p.72

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42. *Symphoricarpos oreophilus* dominates undercover; *Carex geyeri* present or absent 43

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47. *Quercus gambelii* dominates overstory or canopy; *Alnus tenuifolia* absent or rare 48

48. *Quercus gambelii* sole dominant of uppermost canopy; *Symphoricarpos oreophilus* common or well represented; *Prunus virginiana* poorly represented...*Quercus gambelii/Symphoricarpos oreophilus/Carex geyeri* h.t. p.79

48. *Quercus gambelii* and *Prunus virginiana* codominant in uppermost canopy; *Amelanchier* spp. well represented; *Symphoricarpos* spp. poorly represented when present... *Quercus gambelii-Prunus virginiana/Amelanchier utahensis/Pachystima myrsinites* h.t. p.67

B. KEY TO SHRUBLAND HABITAT TYPES

1. Shrubland aspect dominated by woody species of *Artemisia* 2

1. Shrubland aspect dominated by woody species other than *Artemisia* 8

2. *Artemisia tridentata* well represented; other shrubby species of *Artemisia*, other than *Artemisia frigida*, absent or scarce 4

2. Woody species of *Artemisia* other than *tridentata* dominate canopy 3

3. *Artemisia arbuscula* dominates canopy; *Balsamorhiza sagittata* a common associate...*Artemisia arbuscula/Balsamorhiza sagittata* h.t. p.80

3. *Artemisia tripartita* dominates canopy; *Festuca idahoensis* well represented or common...*Artemisia tripartita/ Festuca idahoensis* h.t. p.81

3. *Artemisia cana* dominates canopy; *Festuca thurberi* present...*Artemisia cana/Festuca thurberi* h.t. p.82

4. *Festuca* spp. dominates shrub undercover; *Elymus* spp. and other grasses not well represented when present 5

4. *Elymus* spp. dominates shrub undercover; *Festuca* spp. and other grass taxa absent or not conspicuous 6

4. Grasses other than *Festuca* spp. and *Elymus* spp. dominate shrub undercover; latter two may be present 7

5. *Festuca thurberi* well represented and conspicuous; *Festuca idahoensis* absent or less conspicuous...*Artemisia tridentata/Festuca thurberi* h.t. p.83

5. *Festuca idahoensis* well represented and conspicuous; *Festuca thurberi* absent or poorly represented...*Artemisia tridentata/Festuca idahoensis* h.t. p.84

6. *Elymus cinereus* well represented and conspicuous; *Elymus ambiguus* absent or rare...*Artemisia tridentata/Elymus cinereus* h.t. p.85

6. *Elymus ambiguus* well represented and conspicuous; *Elymus cinereus* absent or rare...*Artemisia tridentata/Elymus ambiguus* h.t. p.86

7. *Agropyron spicatum* primary dominant in herb stratum... *Artemisia tridentata/Agropyron spicatum* h.t. p.87

7. *Stipa comata* conspicuous and primary subdominant... *Artemisia tridentata/Stipa comata* h.t. p.88

7. *Hesperochloa kingii* conspicuous and well represented... *Artemisia tridentata/Hesperochloa kingii* h.t. p.89

8. *Salix* spp. most conspicuous in canopy; other shrubs less abundant when present 13

8. Shrubs other than *Salix* spp. dominate canopy 9

9. *Purshia tridentata* dominates canopy; *Cercocarpus montanus* and *Dryas octopetala* absent or poorly represented 11

9. *Cercocarpus montanus* dominates canopy; *Purshia tridentata* and *Dryas octopetala* absent or not well represented 12

9. *Dryas octopetala* conspicuous and dominant species... *Purshia* and *Cercocarpus* absent 10

10. *Arenaria obtusiloba*, a cushion plant, the primary associate...*Dryas octopetala/Arenaria obtusiloba* h.t. p.90

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11. *Muhlenbergia montana* well represented and conspicuous; *Stipa comata* poorly represented when present...*Purshia tridentata/Muhlenbergia montana* h.t. p.92

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13. *Salix planifolia* most conspicuous in cover; other *Salix* spp. absent or less abundant 14

13. *Salix pseudolapponum* dominates canopy; other *Salix* spp. absent or less conspicuous 15

13. *Salix arctica* most conspicuous cover member; other *Salix* spp. absent or poorly represented...*Salix arctica/Geum rossii* h.t. p.97

14. *Deschampsia caespitosa* well represented in cover...*Salix planifolia/Deschampsia caespitosa* h.t. p.98

14. *Carex aquatilis* a conspicuous cover component...*Salix planifolia/Carex aquatilis* h.t. p.99

14. *Carex scopulorum* most conspicuous secondary species...*Salix planifolia/Carex scopulorum* h.t. p.100

14. *Caltha leptosepala* conspicuous in cover...*Salix planifolia/Caltha leptosepala* h.t. p.101

15. *Deschampsia caespitosa* dominates the undercover; *Geum rossii* well represented but not dominant in lower stratum...*Salix pseudolapponum/Deschampsia caespitosa* h.t. (A) p.102

15. *Deschampsia caespitosa* dominates the undercover...*Geum rossii* is well represented and subdominant...*Salix pseudolapponum/Deschampsia caespitosa/Geum rossii* h.t. (B) p.103

16. *Chrysothamnus viscidiflorus* dominates the canopy; *Artemisia* spp. absent or poorly represented in cover...*Chrysothamnus viscidiflorus/Agropyron spicatum* h.t. p.104

C. KEY TO GRASSLAND HABITAT TYPES

1. True grasses dominate aspect of canopy; other graminoids may be absent or compose lesser fractions of cover 6

1. *Carex* spp. or *Juncus* spp. dominate canopy cover; not true grasses 2

2. *Juncus balticus* dominates canopy cover; *Carex* spp. usually present but less conspicuous...*Juncus balticus/Carex* h.t. p.105

2. Certain species of *Carex* dominate canopy cover; *Juncus* absent or less conspicuous 3

3. *Carex rupestris* most conspicuous cover component 4

3. *Carex rupestris* not conspicuous cover component; other *Carex* spp. or *Kobresia bellardii* more conspicuous 5

4. *Trifolium dasyphyllum* common or well represented... *Carex rupestris/Trifolium dasyphyllum* h.t. p.106

4. *Geum rossii* well represented or common in cover... *Carex rupestris/Geum rossii* h.t. p.107

5. *Carex scopulorum* dominates cover aspect; *Carex rostrata* less conspicuous when present; *Caltha leptosepala* present...*Carex scopulorum/Caltha leptosepala* h.t. p.108

5. *Carex rostrata* most conspicuous cover component; *Carex aquatilis* well represented; *Carex elynoides* not common... *Carex rostrata/Carex aquatilis* h.t. p.109

6. *Carex elynoides* most conspicuous in cover; *Kobresia bellardii* absent or less conspicuous...*Carex elynoides/Geum rossii* h.t. p.110

6. *Kobresia bellardii* most conspicuous in canopy cover... *Kobresia bellardii/Geum rossii* h.t. p.111

7. *Andropogon* spp. dominate canopy aspect; other grasses poorly represented or less conspicuous 8

7. Grass species other than *Andropogon* spp. dominate aspect of vegetal cover; latter absent or poorly represented 9

8. *Andropogon gerardii* most conspicuous in vegetal cover; *Andropogon hallii* absent or inconspicuous; *Andropogon scoparius* (= *Schizachyrium scoparium*) well represented... *Andropogon gerardii/Andropogon scoparius* h.t. p.112

8. *Andropogon hallii* most conspicuous cover component; *A. gerardii* absent or poorly represented; *Calamovilfa longifolia* common...*Andropogon hallii/Calamovilfa longifolia* h.t. p.113

9. *Agropyron* spp. dominate canopy cover; other grass species less conspicuous 10

9. *Agropyron* spp. not conspicuous in vegetal cover; species of other grass genera dominate canopy cover 11

10. *Agropyron smithii* most conspicuous canopy member; *Bouteloua gracilis* well represented...*Agropyron smithii/Bouteloua gracilis* h.t. p.114

10. *Agropyron spicatum* dominates canopy cover; *Poa sandbergii* present in canopy; *Agropyron spicatum/Poa sandbergii* h.t. p.115

11. *Danthonia* spp. dominate canopy cover; species of other genera absent or poorly represented 12

11. Species of genera other than *Danthonia* dominate canopy cover 13

12. *Danthonia intermedia* most conspicuous in vegetal cover; *Erigeron simplex* common or well represented...*Danthonia intermedia/Erigeron simplex* h.t. p.116

12. *Danthonia parryi* most conspicuous canopy cover member; *Carex heliophila* common or well represented...*Danthonia parryi/Carex heliophila* h.t. p.117

13. *Deschampsia caespitosa* dominates canopy aspect; species of other grass genera less conspicuous 14

13. *Deschampsia caespitosa* not conspicuous in vegetal cover; species of other grass genera canopy dominants 15

14. *Geum rossii* well represented in vegetal cover...*Deschampsia caespitosa/Geum rossii* h.t. p.118

14. *Caltha leptosepala* well represented in cover...*Deschampsia caespitosa/Caltha leptosepala* h.t. ... p.119

15. Species of *Festuca* dominate canopy cover; other grass species absent or less conspicuous 16

15. Species of genera other than *Festuca* most conspicuous in vegetal cover 19

16. *Festuca idahoensis* dominates canopy cover; *Festuca thurberi* absent or less conspicuous 17

16. *Festuca thurberi* dominates cover; *Festuca idahoensis* absent or less conspicuous 18

17. *Agropyron trachycaulum* subdominant in canopy...*Festuca idahoensis/Agropyron trachycaulum* h.t. p.120

17. *Geranium nervosum* present..*Festuca idahoensis/Geranium nervosum* h.t. p.121

18. *Festuca idahoensis* common...*Festuca thurberi/Festuca idahoensis* h.t. p.122

18. *Vicia americana* and/or *Lathyrus leucanthus* present and secondary...*Festuca thurberi/Vicia americana-Lathyrus leucanthus* h.t. p.123

19. *Calamovilfa longifolia* most conspicuous canopy member; species of other grass genera less prominent 20

19. *Calamovilfa longifolia* not conspicuous in vegetal cover; species of other grass genera dominate canopy cover 21

20. *Andropogon hallii* common or well represented; *Bouteloua gracilis* inconspicuous if present... *Calamovilfa longifolia/Andropogon hallii* h.t. p.124

20. *Bouteloua gracilis* common or well represented; *Andropogon hallii* absent or inconspicuous... *Calamovilfa longifolia/Bouteloua gracilis* h.t. p.125

21. *Bouteloua gracilis* most conspicuous member in vegetal cover; *Agropyron smithii* present...*Bouteloua gracilis/Agropyron smithii* h.t. p.126

21. *Bouteloua gracilis* absent or minor component; other grass species dominate canopy cover 22

22. *Elymus ambiguus* dominates canopy cover; *Stipa comata* absent or poorly represented; *Ribes cereum* present... *Elymus ambiguus/Ribes cereum* h.t. p.127

22. *Stipa comata* most conspicuous canopy member; *Elymus Ambiguus* and *Poa nervosa* absent or uncommon 23

23. *Bouteloua gracilis* .....well represented; *Muhlenbergia montana* absent or poorly represented 24

23. *Muhlenbergia montana* .....well represented; *Bouteloua gracilis* absent or inconspicuous...*Stipa comata/Muhlenbergia montana* h.t. p.128

24. Moderate to deep solums with distinct B horizons developed from granite, gneiss or schist... *Stipa comata/Bouteloua gracilis* h.t. (A) p.129

24. Shallow solums without distinct B horizon developed from limestone...*Stipa comata/Bouteloua gracilis* h.t. (B) p.130

25. *Poa nervosa* dominates canopy cover; *Stipa lettermanii* well represented in cover...*Poa nervosa/Stipa lettermannii* h.t. p.131

D. KEY TO FORBLAND HABITAT TYPES

1. *Geum rossii* dominates aspect and canopy cover; *Polygonum bistortoides* well represented; other forb species less conspicuous...*Geum rossii/Polygonum bistortoides* h.t. p.132

1. *Geum rossii* not well represented in cover; other forb species dominate aspect and cover 2

2. *Ligusticum porteri* dominates canopy cover and aspect; *Vicia americana* and/or *Lathyrus leucanthus* present... *Ligusticum porteri/Vicia americana-Lathyrus leucanthus* h.t. p.133

2. *Ligusticum porteri* absent or rare; *Trifolium nanum* cover dominant; other cushion plants present...*Trifolium nanum/Paronychia pulvinata* h.t. p.134

Pinus ponderosa/Cercocarpus montanus h.t. (*PIPO/CEMO* h.t.)
(A)

Plant Association: Open woodland (averaging 88 ft^2/acre basal area) dominated by *Pinus ponderosa*; *Juniperus scopulorum* and *Pseudotsuga menziesii* minor tree componenta; *Cercocarpus montanus*dominates shrub canopy; low to moderate species diversity. A partial list of species with high constancy follows (% canopy coverage, when available, in parentheses):

Tree Stratum: *Pinus ponderosa* (major), *Juniperus scopulorum* (minor), *Pseudotsuga menziesii* (minor).

Shrub Stratum

Medium Shrub: *Cercocarpus montanus* (14%).

Low Shrub: *Artemisia frigida* (1%), and *Opuntia polyacantha* (t).

Herbaceous Stratum

Graminoids: *Agropyron griffithsii* (1%), *Bouteloua gracilis* (1%), *Carex rossii* (4%), *Koeleria cristata* (t), *Muhlenbergia montana* (2%), and *Stipa comata* (1%).

Forbs: *Allium textile* (t), *Cystopteris fragilis* (t), *Eriogonum umbellatum* (1%), *Geranium fremontii* (1%), and *Leucocrinum montanum* (t).

Distribution: Major forestland habitat type of the foothill and lower montane zone of the front range of the northern Colorado Rocky Mountains; dry, rocky hillsides immediately above shrub-steppe.

Site Characteristics: Elevational Range -- 1,900m (6230) to 2,250m (7380)
Aspect Range -- southeast to southwest
Slope % Range -- 35% to 60%
Topographic Position -- occupies most xeric sites of the *Pinus ponderosa* series; moderate to steeply inclined, low to mid slope positions of non-northerly aspects; landscape relief variable.

Soil Characteristics: Moderately shallow, sandy loam to loamy sand, gravelly and cobbly soils; solum, rarely exceeding 35cm in depth, consists of thin A horizon and weakly expressed cambic B horizon; coarse fragment content of the solum frequently exceeds 40%. The A-horizon pH ranges from 5.6 to 7.0. Colluvial gneiss, schist, and granite comprise the primary parent material.

Soil Families: sandy-skeletal mixed frigid Typic Ustochrept
loamy-skeletal mixed mesic Typic Ustochrept
loamy-skeletal mixed frigid Typic Ustochrept
sandy-skeletal mixed frigid Typic Ustorthent

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Special Note: See *PIPO-JUSC/CEMO* h.t. (B) on following page.

Pinus ponderosa-Juniperus scopulorum/Cercocarpus montanus h.t. (*PIPO-JUSC/CEMO* h.t.) (B)

Plant Association: Open woodland dominated by *Pinus ponderosa* and *Juniperus scopulorum* with *Cercocarpus montanus* as secondary component; moderate species diversity. A partial list list of species with high constancy follows (% average frequency in parentheses):

Tree Stratum -- *Pinus ponderosa* (2% - 9% by age class), *Juniperus scopulorum* (13%).

Shrub Stratum

Tall Shrub: *Cercocarpus montanus* (85%), *Rhus trilobata* (10%).

Low Shrub: *Symphoricarpos albus* (27%), *Rosa woodsii* (2%), *Artemisia frigida* (9%).

Herbaceous Stratum

Graminoids: *Andropogon scoparius* (38%), *Agropyron griffithsii* (24%), *Bouteloua curtipendula* (19%), *Koeleria cristata* (14%).

Forbs: *Lupinus parviflorus* (18%), *Achillea millefolium* (3%), *Solidago occidentalis* (7%), and *Zygadenus elegans* (2%).

Distribution: Minor but distinctive habitat type due to occurrence of *Cercocarpus montanus* occurring in the drier transitions between *Pinus ponderosa* forests and the prairies in the Black Hills, S.D.; to be expected southward along the east-front ranges in Wyoming and Colorado. Precipitation 457mm to 508mm per annum.

5000 5480

Site Characteristics: Elevational Range -- 1,524m to 1,669m
Aspect Range -- SW to SE
Slope % Range -- Recorded but not published
Topographic Position -- Recorded but not published

Soil Characteristics: Limestone parent material for all soils. Horizon sequence: A1/AC/C/R; soil texture stony or gravelly loam throughout the solum. Solum depths vary from 18cm to 79cm; all horizons strongly effervescent when HCL applied.

Soil Families: Information not available

Source Reference: Thilenius (1972), no. HU-10; Terwilliger et al (1979), no. 66, revised.

Geographic Reference: Black Hills National Forest.

Special Note: This habitat type appears to be very similar to the *PIPO/CEMO* h.t. of the Roosevelt National Forest and, as such, should properly be included in that habitat type. Its separate listing reflects geographical, soils, and other environmental differences.

Pinus ponderosa/Purshia tridentata h.t. (*PIPO/PUTR* h.t.)

Plant Association: Submesic, foothill to montane forests dominated by *Pinus ponderosa* in the tree stratum and by *Purshia tridentata* in the shrub layer; moderately open tree canopy, moderately high species diversity, but somewhat low canopy coverage of the understory. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus ponderosa* and *Pseudotsuga menziesii*.
Shrub Stratum -- *Purshia tridentata* (24%) and *Ribes cereum* (t).
Herbaceous Stratum
Graminoids: *Muhlenbergia montana* (2%), *Carex rossii* (2%), *Carex heliophila* (1%), and *Koeleria cristata* (1%).
Forbs: *Penstemon virens* (1%), *Potentilla fissa* (1%), and *Geranium fremontii* (1%).

Distribution: Major habitat type and a predominant landscape unit of the montane zone in the northern Roosevelt National Forest; common on gently to steeply sloping south facing hillsides of the Poudre and Red Feather Districts.

Site Characteristics: Elevational Range -- 2,300m to 2,700m
Aspect Range -- southerly to northeasterly
Slope % Range -- 0% to 54%
Topographic Position -- gently to steeply inclined, south facing, exposed mountain hillsides and rolling uplands.

Soil Characteristics: Relatively deep, sandy loam textured Alfisols with thin organic surficial layers, moderately well developed A and argillic B horizons derived from metamorphic, and igneous colluvium. Coarse fragment content of solum generally exceeds 40%. The pH of the A horizon is 6.2 to 6.8.

Soil Families: loamy-skeletal mixed frigid Mollic Eutroboralfs.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus ponderosa/Symphoricarpos albus h.t. (*PIPO/SYAL* h.t.)

Plant Association: Coniferous forest dominated entirely by *Pinus ponderosa*; *Symphoricarpos albus* major lower stratal species; moderately high species diversity. A partial list of species with high constancy follows (% frequency in parentheses):

Tree Stratum -- *Pinus ponderosa* (2% to 62% by age classes).
Shrub Stratum
Tall Shrub (minor): *Prunus virginiana* (8%).
Low Shrub: *Symphoricarpos albus* (29%), *Rosa woodsii* (13%), *Amelanchier alnifolia* (12%), and *Arctostaphylos uva-ursi* (39%).
Herbaceous Stratum
Graminoids: *Danthonia intermedia* (14%), *Carex concinna* (15%), and *Oryzopsis asperifolia* (13%).
Forbs: *Achillea millefolium* (9%), *Apocynum androsaemifolium* (6%), *Antennaria neglecta* (5%), *Campanula rotundifolia* (3%), and *Solidago occidentalis* (4%).

Distribution: Most widely distributed habitat type in the Black Hills, South Dakota; occurs over broad elevational range, mostly on non-calcareous geological material and mostly in the 508mm to 559mm precipitation zone.

Site Characteristics: Elevational Range -- 1,136m to 1,860m (3720 6100)
Aspect Range -- variable
Slope % Range -- recorded but not published
Topographic Position -- recorded but not published

Soil Characteristics: Soil depth varies between 15cm and 76cm; upper soil horizon quite rocky, continuing above surface with vertically oriented rock outcrops; subsoil generally acidic; horizon sequence either A1/A2/B2/C or A1/B2/C.

Soil Families: Information not available. Soil profiles accessible from reference.

Source Reference: Thilenius (1972), no. HU-5; Terwilliger et al (1979), no. 65.

Geographic Reference: Black Hills National Forest.

Pinus ponderosa/Juniperus communis h.t. (*PIPO/JUCO* h.t.) = Pipo/Juco-Syal

Plant Association: Mesic forest dominated by *Pinus ponderosa*; *Juniperus communis* principal shrub component; high species diversity in lower shrub and herbaceous strata. A partial list of species with high constancy follows (% frequency in parentheses):

Tree Stratum -- *Pinus ponderosa* (10% to 30% in various size classes), *Populus tremuloides* (4% to 10% in various size classes), and *Picea glauca* (4% to 6% in various size classes).

Shrub Stratum

Tall Shrub: *Juniperus communis* (27%).

Low Shrub: *Symphoricarpos albus* (44%), *Rosa woodsii* (49%), *Amelanchier alnifolia* (14%), *Berberis repens**(42%), and *Arctostaphylos uva-ursi* (47%).

Herbaceous Stratum

Graminoids: *Oryzopsis asperifolia* (27%), *Danthonia intermedia* (19%), *Poa pratensis*+(18%), and *Carex concinna* (7%).

Forbs: *Fragaria vesca* (25%), *Achillea millefolium* (25%), *Galium biflorum* (22%), *Viola adunca* (8%), and *Vicia americana* (10%).

*Unique indicator of the habitat type
+Naturalized exotic

Distribution: Very common and extensive habitat type found on limestone plateaus at higher elevations and in the 508mm to 559mm precipitation zone in northwestern and western Black Hills, South Dakota.

Site (left out)

Site Characteristics: Soils developed from limestone parent material. Well expressed horizonation with A1/A2/B2/C sequence. Average solum depth 30cm. Soil reaction neutral to basic throughout entire solum; strongly effervescent with HCL in the lower horizons.

Soil Families: Information not available. Soil profile descriptions given in reference.

Source Reference: Thilenius (1972), HU-1; Terwilliger et al (1979), no. 67.

Geographic Reference: Black Hills National Forest.

= Pipo-Quma/Prvi-Syal

Pinus ponderosa-Quercus macrocarpa/Prunus virginiana h.t. (*PIPO-QUMA/PRVI* h.t.)

Plant Association: Mixed forest with *Pinus ponderosa* sharing dominance with *Quercus macrocarpa*; *Prunus virginiana* principal component of highly dense and diverse shrub layer. A partial list of species with high constancy follows (% frequency in parentheses):

Tree Stratum -- *Pinus ponderosa* (20% to 43% in various size classes) and *Quercus macrocarpa* (42%).

Shrub Stratum

Tall Shrub: *Prunus virginiana* (66%) and *Quercus macrocarpa* (42%).

Low Shrub: *Symphoricarpos albus* (56%), *Amelanchier alnifolia* (37%), *Spiraea lucida* (25%), *Berberis repens* (73%), and *Toxicodendron radicans* (12%).

Herbaceous Stratum

Graminoids: *Danthonia intermedia* (26%), *Poa pratensis** (20%), and *Carex foenea* (12%).

Forbs: *Monarda fistulosa* (12%), *Lathyrus ochroleucus* (11%), *Achillea millefolium* (10%), *Vicia americana* (5%), and *Viola adunca* (5%).

*Naturalized exotic. Useful indicator species include *Maianthemum canadense* and *Sanicula marilandica*.

Distribution: Minor habitat type found at lower elevations along the northern edge of the Black Hills, South Dakota; located on calcareous parent material in 508mm to 559mm precipitation zones.

3840 4550

Site Characteristics: Elevational Range -- 1,173m to 1,387m
Aspect Range -- recorded but not published
Slope % Range -- recorded but not published
Topographic Position -- recorded but not published

Soil Characteristics: Average solum depth 62cm (range of 36cm to 74cm). Profile exhibits well developed horizonation: A1/A2/B2/C. Soil reaction neutral to basic. Litter horizon thick, reflecting debris accumulation from deciduous shrubs.

Soil Families: Information not available. Profile data accessible from reference.

Source Reference: Thilenius (1972), no. HU-6; Terwilliger et al (1979).

Geographic Reference: Black Hills National Forest.

= Pipo/Quga (2)

Pinus ponderosa/Quercus gambelii/Carex geyeri h.t. (*PIPO/QUGA/CAGE* h.t.)

Plant Association: Submesic, intermediate elevation coniferous woodland characterized by dominance of *Pinus ponderosa* in the tree stratum, *Quercus gambelii* in the shrub layer, and *Carex geyeri* in the herb layer; an open tree canopy, weakly moderate species diversity and canopy coverage except for a paucity of forbs. A partial list of species with high coverage follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus ponderosa*, *Pseudotsuga menziesii*, and *Juniperus scopulorum*.
Shrub Stratum -- *Quercus gambelii* (15%), *Juniperus communis* (4%), and *Symphoricarpos oreophilus* (3%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (18%) and *Koeleria cristata* (1%).
Forbs: *Balsamhoriza sagittata* (2%), *Achillea lanulosa* (1%), and *Pulsatilla ludoviciana* (1%).

Distribution: Minor forestland habitat type in the northwestern and northeastern fringes of the White River National Forest.

7790 8370

Site Characteristics: Elevational Range -- 2,375m to 2,550m
Aspect Range -- southerly and easterly
Slope % Range -- 10% to 40%
Topographic Position -- south to east facing gentle to moderately inclined slopes of intermediate mountain elevations.

Soil Characteristics: Shallow, moderately permeable soils typically have a thin layer of needle litter on top of a brown, fine sandy loam surface layer about 8 cm thick and the subsurface is brown, fine sandy loam, about 18 cm thick with weathered sandstone at about 26 cm depth.

Soil Families: loamy mixed frigid (nonacid) Lithic Ustorthent.

Source Reference: Hess and Wasser (1982).

only 1 Jan!

Geographic Reference: White River National Forest.

=Pipo/Ansc-Agsm

Pinus ponderosa/Andropogon scoparius h.t. (*PIPO/ANSC* h.t.)

Plant Association: Open woodlands interspersed among prairie grasslands; dominated by *Pinus ponderosa* with *Andropogon scoparius* principal species in herbaceous layer. High species diversity among grasses and forbs, many of which have prairie affinities. A partial list of species with high constancy follows (% frequency in parentheses):

Tree Stratum -- *Pinus ponderosa* (2% to 18% for various size classes) and *Juniperus scopulorum* (4%).

Shrub Stratum

Tall Shrub: *Rhus trilobata* (2%).

Low Shrub: *Rosa woodsii* (4%) and *Symphoricarpos albus* (21%).

Herbaceous Stratum

Graminoids: *Andropogon scoparius* (37%), *Koeleria cristata* (4%), and *Carex foenea* (17%).

Forbs: *Achillea millefolium* (5%), *Schizachne purpurascens* (13%), *Iris missouriensis* (2%), *Grindelia squarrosa* (2%), *Solidago occidentalis* (10%), *Vicia americana* (7%), and *Campanula rotundifolia* (2%).

Grass!

?

Distribution: Minor, though locally abundant, habitat type confined to low and dry regions of the southwestern Black Hills, South Dakota; receives 457mm to 508mm annual precipitation; commonly found in ecotones between prairie and ponderosa pine to the south.

4820 5480

Site Characteristics: Elevational Range -- 1,471m to 1,669m
Aspect Range -- variable
Slope % Range -- recorded but not published
Topographic Position -- recorded but not published

Soil Characteristics: Solum depth averages 50cm; horizon sequence: A1/B2/C/R. Soil neutral to basic in subsurface horizons. Dark brown, thick surface horizon associated with abundant fibrous roots of graminoid species.

Soil Families: Information not available. Soil profile data accessible.

Source Reference: Thilenius (1972), no. HU-11; Terwilliger et al (1979), no. 62.

Geographic Reference: Black Hills National Forest.

This is still confused.

Pinus ponderosa/Muhlenbergia montana h.t. (*PIPO/MUMO* h.t.)

Plant Association: Subhumid medium elevational forests dominated by *Pinus ponderosa* in the tree stratum and by *Muhlenbergia montana* in the herbaceous layer; relatively open and low tree canopy, moderate species diversity, and moderately sparse canopy cover of the understory most pronounced in the shrub layer. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus ponderosa* and *Pseudotsuga menziesii*.
Shrub Stratum -- *Ribes cereum* (1%) and *Ribes deliciosus* (t).
Herbaceous Stratum
Graminoids: *Muhlenbergia montana* (11%), *Agropyron griffithsii* (2%), *Muhlenbergia filiculmis* (1%), and *Hesperochla kingii* (t).
Forbs: *Chrysopsis villosa* (2%), *Eriogonum umbellatum* (1%), *Geranium fremontii* (1%), and *Sedum stenopetalum* (1%).

Distribution: Minor habitat type of the montane zone; common on exposed hilltops and moderately to steeply sloping, south facing mountains, chiefly in the upper limits of the *Pinus ponderosa* series, and found chiefly in the Boulder district of the Roosevelt National Forest.

Site Characteristics: Elevational Range -- 2,400m to 2,675m
Aspect Range -- southerly to northeasterly
Slope % Range -- 11% to 54%
Topographic Position -- exposed hilltops and moderate to steeply sloping, south facing mountain slopes.

Soil Characteristics: Poorly developed, mollic epipedons with or without cambic B horizons and relatively shallow, coarse textured Haploborolls; very shallow, coarse textured A horizons overlying skeletal C horizons in Ustothorents. Both soils derived from granitic parent material. Coarse fragment content frequently exceeds 40%. The pH of A horizons range from 6.2 to 6.8.

Soil Families: sandy-skeletal mixed frigid Ustothorents;
loamy-skeletal mixed frigid Entic Haploborolls;
sandy-skeletal mixed frigid Typic Haploborolls;
loamy-skeletal mixed frigid Typic Haploborolls;
sandy-skeletal mixed frigid Entic Haploborolls.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus ponderosa/Carex rossii h.t. (*PIPO/CARO* h.t.)

Plant Association: Semi-mesic, lower middle elevation forests dominated by *Pinus ponderosa* in the tree layer and by *Carex rossii* in the herb stratum; relatively closed tree canopy, moderate species diversity and rather low canopy coverage of undercover strata. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus ponderosa*.
Shrub Stratum -- *Juniperus communis* (1%) and *Cercocarpus montanus* (t).
Herbaceous Stratum
Graminoids: *Carex rossii* (10%) and *Hesperochloa kingii* (1%).
Forbs: *Mertensia lanceolata* (t), and *Harbouria trachypleura* (t).

Distribution: Minor, forested, lower montane habitat type that is widely distributed; common on gentle to moderately sloping terrain of variable exposure but on northerly aspects at lowest elevations; it is found in all Roosevelt National Forest districts.

Site Characteristics: Elevational Range -- 1,900m to 2,450m
Aspect Range -- variable
Slope % Range -- 7% to 38%
Topographic Position -- gently to moderately sloping terrain of variable exposure; northerly aspects at lower elevations and southerly exposures at lower slope positions

Soil Characteristics: Variable depth alfisols and entisols derived from alluvial and colluvial deposits of variable sedimentary to igneous origins. The former are relatively deep, sandy loam to loam textured solums with thin layers of humus and litter, distinct A1 horizons (A2 may also be present), and well developed argillic B horizons. Coarse fragment content moderate and pH of A horizon of both soil types range from 6.0 to 6.7. Needle litter dominates the ground cover.

Soil Families: coarse-loamy mixed frigid Typic Eutroboralfs;
fine-loamy mixed frigid Typic Eutroboralfs;
loamy-skeletal mixed frigid Typic Ustorthents.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus ponderosa/Hesperochloa kingii h.t. (*PIPO/HEKI* h.t.)

Plant Association: Mesic, low to middle elevation forests dominated by *Pinus ponderosa* in the tree stratum and by *Hesperochloa kingii* in the herb layer; and characterized by a relatively closed tree canopy, moderately high species diversity and rather low shrub and forb canopy cover. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus ponderosa*.
Shrub Stratum -- *Ribes cereum* (3%).
Herbaceous Stratum
Graminoids: *Hesperochloa kingii* (10%) and *Koeleria cristata* (t).
Forbs: *Geranium fremontii* (1%), *Harbouria trachypleura* (1%), *Allium geyeri* (t) and *Sedum stenopetalum* (t).

Distribution: Major habitat type, moderately extensively areally; found in all forest districts of the Roosevelt National Forest.

Site Characteristics: Elevational Rnage -- 2,200m to 2,600m
7210 8530
Aspect Range -- variable
Slope % Range -- 12% to 40%
Topographic Position -- chiefly on non-southerly exposures at most slope positions and restricted to most mesic *Pinus ponderosa* sites.

Soil Characteristics: Loamy to sandy loam textured solums relatively deep with distinct A1 horizons (A2 may also be present) and well developed argillic B horizons. Coarse fragment content varies from 0% to 40%. The pH of the A horizons range from 5.8 to 6.6. Needle litter covers most of the ground surfaces.

Soil Families: fine-loamy mixed frigid Mollic Eutroboralf; coarse-loamy mixed frigid Mollic Eutroboralf; loamy-skeletal mixed frigid Mollic Eutroboralf.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pseudotsuga menziesii/Physocarpus monogynus h.t. (*PSME/PHMO* h.t.)

Plant Association: Mesic, middle elevation forests dominated by *Pseudotsuga menziesii* in the tree stratum and by *Physocarpus monogynus* in the shrub layer; and having a closed tree canopy, moderate species diversity and low herbaceous canopy coverage. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pseudotsuga menziesii* and *Pinus ponderosa*.
Shrub Stratum -- *Physocarpus monogynus* (20%), and *Jamesia americana* (3%).
Herbaceous Stratum
Graminoids: *Hesperochloa kingii* (2%).
Forbs: *Potentilla fissa* (1%), *Achillea lanulosa* (t), *Campanula rotundifolia* (t), *Delphinium nelsoni* (t), and *Galium boreale* (t).

Distribution: Major habitat type on steep north to northwest facing slopes; widely distributed east of Continental Divide in all forest districts of the Roosevelt National Forest.

Site Characteristics: Elevational Range -- 1,800m to 2,450m
Aspect Range -- north to northwesterly
Slope % Range -- 55% to 64%
Topographic Position -- steep north and northwest facing slopes at midslope positions of high mountain ranges east of Continental Divide.

Soil Characteristics: Medium textured solums developed from granite, gneiss, and schist colluvium, of variable depth (26-80 cm), having conspicuous litter and humus surficial layers on top of a moderately deep A horizon and a cambic B horizon. Both A1 and A2 horizons usually present. Coarse fragment content commonly exceeds 40%; pH of the A horizon is 6.3 to 6.6.

Soil Families: loamy-skeletal mixed frigid Typic Eutroboralf; loamy-skeletal mixed Typic Cryoboralf, latter at higher elevations.

Source Reference: Hess (1981).

Geographic Range: Roosevelt National Forest.

Pseudotsuga menziesii/Jamesia americana h.t. (*PSME/JAAM* h.t.)

Plant Association: Mesic, intermediate elevation forests characterized by dominance of *Pseudotsuga menziesii* in the tree layer and by *Jamesia americana* in the shrub stratum; and by a closed forest canopy, moderate species diversity, and low canopy coverage of understory, most conspicuous in the herb layer. A partial list list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pseudotsuga menziesii, Pinus ponderosa, Juniperus sopulorum.*
Shrub Stratum -- *Jamesia americana* (22%), *Juniperus communis* (7%), *Physocarpus monogynus* (7%), and *Acer glabrum* (1%).
Herbaceous Stratum
Graminoids: *Carex rossii* (t).
Forbs: *Potentilla fissa* (1%), *Saxifraga bronchialis* (1%), *Fragaria ovalis* (t), *Anaphilis margaritacea* (t), *Campanula rotundifolia* (t), and *Cystopteris fragilis* (t).

Distribution: Minor forested habitat type widely distributed in the Roosevelt National Forest; common on steep to very steep north facing slopes in rocky to bouldery outcroppings.

Site Characteristics: Elevational Range -- 2,200m to 2,550m
Aspect Range -- northerly to northwesterly
Slope % Range -- 55% to 75%
Topographic Position -- limited to rock and boulder outcroppings at upper limits of PSME series east of Continental Divide.

Soil Characteristics: Moderately coarse to medium textured solums of shallow to moderate depths (16-48 cm) layers, moderately deep A horizons and weakly expressed cambic or argillic B horizons. Coarse fragments range from 35 to 50% and the pH of A horizons vary from 6.2 to 6.8. Significant proportions (25-35%) of ground surface is covered by exposed rock. Parent materials are composed of granitic-gneissic-schistic colluvium.

Soil Families: loamy-skeletal mixed frigid Typic Eutroboralf; loamy-skeletal mixed frigid Typic Eutrochrept; loamy-skeletal mixed Typic Cryochrept (latter at higher elevations).

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pseudotsuga menziesii/Pachystima myrsinites h.t. (*PSME/PAMY* h.t.)

Plant Association: Mesic, high elevation forests characterized by dominance of *Pseudotsuga menziesii* in the tree stratum and by *Pachystima myrsinites* in shrub layer; a rather closed upper tree canopy, relatively low species diversity, and rather sparse canopy coverage except for *Pachystima*. A partial list of species with high constancy follows (% canopy coverage for nontree species in parentheses):

Tree Stratum -- *Pseudotsuga menziesii*, *Picea engelmannii*, and *Abies lasiocarpa*.
Shrub Stratum -- *Pachystima myrsinites* (24%), *Berberis repens* (1%), *Acer glabrum* (1%), *Amelanchier utahensis* (t), *Symphoricarpos oreophilus* (1%), and *Rosa woodsii* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (2%) and *Bromus anomalus* (t).
Forbs: *Arnica cordifolia* (2%) and *Aquilegia caerulea* (t).

Distribution: Minor habitat type locally abundant in the southeastern and southern White River National Forest.

Site Characteristics: Elevational Range -- 2,425m to 2,700m
Aspect Range -- northerly
Slope % Range -- 64% to 101%
Topographic Position -- on steeply to very steeply inclined slopes of northerly exposures at a higher elevation than *PSME/CAGE* h.t.

Soil Characteristics: The moderately deep and moderate to slow permeability soils typically have a thin layer of forest litter superposed on a 6 cm thick brown loam surface layer which is underlain by a subsurface layer that is pinkish gray, very gravelly, clay loam approximately 40 cm thick over a gravelly, clay loam subsoil of sandstone origin. Surface soil layer is circumneutral (pH 6.4 - 7.2).

Soil Families: clayey-skeletal and loamy-skeletal mixed Typic Cryoboralfs; loamy-skeletal mixed Cryochrepts; and clayey-skeletal mixed Lithic Cryorthents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

=PSME/SYOR (2)

Pseudotsuga menziesii/Symphoricarpos oreophilus/Carex geyeri h.t. (*PSME/SYOR/CAGE* h.t.)

(A)

Plant Association: Coniferous forest (averaging 113 ft^2/acre basal area) dominated exclusively by *Pseudotsuga menziesii*; *Juniperus scopulorum* occassionally present; *Symporicarpos oreophilus* principal shrub; *Carex geyeri* dominant herbaceous species; species diversity and herbaceous cover moderate. A partial list of species with high constancy follows (% canop coverage -- excluding trees -- in parentheses):

Shrub Stratum -- *Acer glabrum* (1%), *Amelanchier utahensis* (2%), *Berberis repens* (5%), *Pachystima myrsinites* (1%), *Quercus gambelii* (t), and *Symphoricarpos oreophilus* (9%).

Herbaceous Stratum

Graminoids: *Carex geyeri* (10%).

Forbs: *Arnica cordifolia* (2%), *Clematis columbiana* (2%), *Smilicina stellata* (1%), and *Vicia americana* (t).

Tree Stratum -- *Pseudotsuga menziesii* (major) and *Juniperus scopulorum*.

Distribution: A minor though locally abundant habitat type of steep hillsides and canyon walls; widely distributed throughout the north-central Colorado Rocky Mountains at lower elevations; exclusively west of the continental divide.

6890 8200

Site Characteristics: Elevational Range -- 2,100m to 2,500m
Aspect Range -- northwesterly to northeasterly
Slope % Range -- 72% to 88%
Topographic Position -- found on very steep hillsides and canyon walls of mostly northerly exposures; slope position and lanscape relief quite variable.

Soil Characteristics: Deep, silt loam to clay loam, moderately gravelly and cobbly soils; solum, frequently exceeding 100cm in depth, comprised of mollic epipedon or A1/A2 horizon combination and distinct argillic B horizon; coarse fragment content of the solum ranges between 15% and 75%. The A-horizon pH varies from 7.4 to 7.9. Parent material most commonly limestone.

Soil Families: loamy-skeletal mixed Mollic Eutroboralf
clayey-skeletal mixed Mollic Eutroboralf
clayey-skeletal mixed Typic Argiboroll

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Special Note: See *PSME/SYOR* h.t. (B) on following page.

=Psme/Syor1(1)

Pseudotsuga menziesii/Symphoricarpos oreophilus h.t. (*PSME/SYOR* h.t.)
(B)

Plant Association: Coniferous forest dominated exclusively by *Pseudotsuga menziesii*; *Symphoricarpos oreophilus* major secondary species; moderate diversity and cover of herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum -- *Pseudotsuga menziesii* (no cover data).
Shrub Stratum -- *Symphoricarpos oreophilus* (6%), *Berberis repens* (2%), *Juniperus communis* (2%), *Shepherdia canadensis* (2%).
Herbaceous Stratum
Graminoids: *Poa nervosa* (8%), *Agropyron griffithsii* (sic?) (6%), *Bromus marginatus* (6%), *Festuca idahoensis* (6%), and *Carex hoodii* (5%).
Forbs: *Arnica cordifolia* (14%), *Astagalus miser* (4%), and *Antennaria rosea* (1%).

Distribution: Major habitat type on north-facing, very steep slopes at lower elevations in the Wind River Mountains; probably present elsewhere on similar sites in Wyoming, Utah, and Colorado.

Site Characteristics: Elevational Range -- 2,200m to 2,900m
Aspect Range -- mostly north facing
Slope % Range -- recorded but not published
Topographic Position -- steeply sloping, north facing valley (canyon) walls.

Soil Characteristics: Deep, silt loam surface soil and coarse, loamy sand subsoil (soil depth up to 70cm); horizon sequence: A1/B2/C; clay skins on peds in B2 horizon; possible podsolization indicated by occassional B2ir horizons. Surface soil pH is 6.6. High fertility status indicated by high base saturation and exchangeable cations.

Soil Families: Information not available. Complete profile descriptions given.

Source Reference: R.M. Reed (1969;1976).

Geographic Reference: Shoshone National Forest.

Special Note: This habitat type is quite similar to the *PSME/SYOR/CAGE* h.t. of the White River National Forest. The conspicuous absence of *Carex geyeri*, however, prevents the merging of these two into a single habitat type -- particularily when the herbaceous stratum is considered a defining attribute of the habitat type.

Pseudotsuga menziesii/Carex rossii h.t. (*PSME/CARO* h.t.)

Plant Association: Submesic, low elevation forests dominated by *Pseudotsuga menziesii* in the tree layer and by *Carex rossii* in the herb stratum; and having a closed forest canopy, moderate species diversity, and low canopy coverage of understory strata. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pseudotsuga menziesii* and *Pinus ponderosa*.
Shrub Stratum -- *Physocarpus monogynus* (1%), and *Juniperus communis* (1%).
Herbaceous Stratum
Graminoids: *Carex rossii* (5%), and *Agropyron griffithsii* (1%).
Forbs: *Achillea lanulosa* (1%), *Campanula rotundifolia* (1%), *Penstemon virens* (1%), *Artemisia ludoviciana* (t), *Heuchera bracteata* (t), *Pulsatilla ludoviciana* (t), and *Saxifraga rhomboidea* (t).

Distribution: Minor habitat type of steeply inclined, northerly exposures of lower elevation mountains; widely distributed throughout Roosevelt National Forest.

Site Characteristics: Elevational Range -- 1,750m to 1,900m
Aspect Range -- north to northwesterly
Slope % Range -- 48% to 62%
Topographic Position -- steeply sloping, lower mountainous terrain with northerly exposures occupying a landscape position spatially adjacent to the *PIPO/CARO* h.t.

Soil Characteristics: Moderately deep, coarse textured solums having thin litter and humus layers overlying distinct A1 horizons (A2 also may be present) and weakly expressed argillic B horizons. Coarse fragment content frequently exceeds 35%. The pH of A horizons ranges between 6.6 and 6.8. Needle litter covers 80-90% of the ground surface. Parent materials are gneissic, schistic, and granitic colluvium.

Soil Families: loamy-skeletal mixed frigid Mollic Eutroboralfs; loamy-skeletal and coarse-loamy mixed frigid Typic Eutroboralfs.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

→ not included in p.a.

What is this? How does it differ from Psme/Syor1/Cage1 (p.35)? H&W '82 did not have a "Psme/Cage1"

Pseudotsuga menziesii/Carex geyeri h.t.
(*PSME/CAGE* h.t.)

Plant Association: Mesic, intermediate elevation forests dominated in the tree canopy by *Pseudotsuga menziesii*, and by *Symphoricarpos oreophilus* and *Carex geyeri* in the shrub and herb layer, respectively; and characterized by a moderately closed upper canopy, a medium level of species diversity, and weakly moderate canopy coverage. A partial list of species with high constancy follows (% canopy coverage for nontree species in parentheses):

Tree Stratum -- *Pseudotsuga menziesii* and *Juniperus scopulorum*.
Shrub Stratum -- *Symphoricarpos oreophilus* (7%), *Berberis repens* (2%), *Pachystima myrsinites* (1%), *Amelanchier utahensis* (1%), and *Quercus utahensis* (t).
Herbaceous Stratum
Graminoids: *Carex geyeri* (10%) and *Poa interior* (t).
Forbs: *Arnica cordifolia* (1%), *Clematis columbiana* (1%), and *Smilacina stellata* (1%).

Distribution: Locally abundant habitat type found throughout the White River National Forest and in western Arapaho National Forest.

Site Characteristics: Elevation Range -- 2,100m to 3,600m
Aspect Range -- northerly
Slope % Range -- 42% to 88%
Topographic Position -- very steep mountain slopes, northerly oriented, low slope positions.

Soil Characteristics:* The typical soil includes a thin layer of forest litter which covers a very dark, grayish brown, clay loam surface about 8 cm thick. Upper subsoil is brown, gravelly clay loam about 16 cm thick overlying a grayish brown, very gravelly clay loam lower subsoil about 11 cm thick. Substratum is very gravelly sandy clay meeting weathering limestone at 51 cm depth. pH of A horizon is 7.4 to 7.9.

Soil Families: clayey-skeletal mixed Typic Argiboroll, clayey-skeletal mixed and loamy-skeletal mixed Mollic Eutroboralfs on White River; fine-loamy and coarse-loamy mixed Mollic and Typic Cryoboralfs on Arapaho National Forest.

Source: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: White River National Forest; Arapaho National Forest.

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*For White River National Forest.

Picea pungens/Amelanchier alnifolia-Cornus stolonifera/Carex geyeri h.t.
(*PIPU/AMAL-COST/CAGE* h.t.)

Plant Association: Mesic, intermediate elevation forests characterized by dominance of *Picea pungens* in the tree stratum, codominance of *Amelanchier alnifolia* and *Cornus stolonifera* in the shrub layer, and by dominance of *Carex geyeri* in the herb layer; by a tall, closed tree canopy, relatively high species diversity, and moderate to low canopy coverage of the under strata. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea pungens* and *Abies lasiocarpa*.
Shrub Stratum -- *Amelanchier alnifolia* (6%), *Cornus stolonifera* (7%), *Prunus virginiana* (8%), *Acer glabrum* (1%), *Symphoricarpos oreophilus* (2%), and *Rosa woodsii* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (10%), *Agropyron trachycaulum* (t), and *Bromus anomalus* (t).
Forbs: *Smilacina stellata* (4%), *Galium boreale* (1%), *Thalictrum fendleri* (2%), *Fragaria ovalis* (t), *Geranium richardsoni* (t), *Osmorhiza occidentalis* (1%), *Stellaria longipes* (t), and *Viola canadensis* (t).

Distribution: Locally abundant habitat type found on stream benches in low slopes in the western White River National Forest.

7210 8530

Site Characteristics: Elevational Range -- 2,200m - 2,600m
Aspect Range -- variable to none
Slope % Range -- 0% to 42%
Topographic Position -- stream benches and low slope positions of valley bottoms.

Soil Characteristics: Typically well drained soils have a layer of forest litter on the surface about 9 cm thick overlying a dark, grayish brown loam surface layer about 30 cm thick and a dark, grayish brown, gravelly clay loam subsoil about 51 cm thick. Substratum is grayish brown, very gravelly sandy clay of mixed mineralogic origin. The A horizon is mildly alkaline.

Soil Families: fine loamy mixed Pachic Cryoborolls; coarse loamy mixed Mollic Cryofluvents; and sandy-skeletal mixed Typic Cryofluvents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Picea pungens/Arnica cordifolia h.t. (*PIPU/ARCO* h.t.)

Plant Association: Very mesic, middle elevation forests dominated by *Picea pungens* in the tree stratum and by *Arnica cordifolia* in the herb layer; moderate species diversity and rather low canopy coverage of subtree vegetation. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum -- *Picea pungens, Abies lasiocarpa, Pinus contorta, Populus tremuloides.*
Shrub Stratum -- *Juniperus communis* (1%) and *Rosa woodsii* (2%).
Herbaceous Stratum
Graminoids: *Carex foenea* (1%), *Agropyron trachycaulum* (t), *Bromus anomalus* (t), *Carex disperma* (t), and *Oryzopsis asperifolia* (t).
Forbs: *Arnica cordifolia* (18%), *Achillea lanulosa* (1%), *Fragaria ovalis* (1%), *Galium boreale* (1%), *Osmorrhiza depauperata* (1%), and *Smilacina stellata* (1%).

Distribution: Minor forested habitat type in riparian areas along the northern Front Range occupying nearly level benches adjacent to streams and narrow bottomlands flanked by inclined mountain slopes and canyonsides.

Site Characteristics: Elevational Range -- 2,275m to 2,700m
Aspect Range -- northeast to west
Slope % Range -- o% to 9%
Topographic Position -- narrow benches and bottomland areas adjacent to streams and flanked by inclined mountain slopes and canyonsides.

Soil Characteristics: Deep (44-90cm) sandy loam to loam textured solums with dark, mollic epipedons and distinct cambic to argillic B horizons derived from fluvial and alluvial parent materials of diverse origin geologically. Coarse fragment content usually under 15%. The pH of A horizon vaires between 6.0 and 6.6.

Soil Families: fine-loamy mixed Argic Pachic Cryoborolls; coarse-loamy mixed Pachic Cryoborolls.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus contorta/Juniperus communis h.t. (*PICO/JUCO* h.t.)

Plant Association: Semixeric, high elevation forests characterized by dominance of *Pinus contorta* in the tree stratum and by *Juniperus communis* in the shrub layer; moderate species diversity, a closed canopy, and relatively low canopy coverage of nontree strata. A partial list of species with high constancy follows (% canopy coverage of nontree members in parentheses):

Tree Stratum -- *Pinus contorta* and *Populus tremuloides*.
Shrub Stratum -- *Juniperus communis* (12%) and *Arctostaphylos uva-ursi* (2%).
Herbaceous Stratum
Forbs: *Arnica cordifolia* (1%), *Potentilla fissa* (1%), *Sedum stenopetalum* (t), and *Thermopsis divaricarpa* (t).

Distribution: Common forested habitat type east of the Continental Divide on gently to moderately sloping, rather high elevation mountains. It extends higher on south facing exposures and lower on north facing exposures.

Site Characteristics: Elevational Range -- 2,550m to 2,750m
Aspect Range -- variable
Slope % Range -- 10% to 45%
Topographic Position -- gently to moderately sloping high mountain surfaces of varied exposure.

Soil Characteristics: Moderately deep (30-63 cm), sandy loam to sandy clay loam solums having conspicuous albic A horizons and well expressed argillic B horizons. Coarse fragment content of the solum usually exceeds 40%. The pH of the A horizon varies from 5.4 to 6.2. Ground surface is moderately well covered by needle litter.

Soil Families: fine-loamy mixed Cryoboralfs;
loamy-skeletal mixed Cryoboralfs.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

Pinus contorta/Shepherdia canadensis h.t. (*PICO/SHCA* h.t.)[1]

Plant Association: Submesic, high elevation forests characterized by dominance of *Pinus contorta* in the tree stratum and by *Shepherdia canadensis* in the shrub layer; and by moderate species diversity and rather high canopy coverage particularly in the tree and shrub strata. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus contorta*.
Shrub Stratum -- *Shepherdia canadensis* (33%), *Vaccinium scoparium* (18%), *Juniperus communis* (6%), and *Berberis repens* (1%).
Herbaceous Stratum
Graminoids: *Carex rossii* (1%) and *Carex geyeri* (t).
Forbs: *Epilobium angustifolium* (t), *Pyrola* spp. (t), *Astragalus miser* (t), *Solidago* spp. (t).

Distribution: Major habitat type found throughout the Arapaho National Forest, on lands adjacent to the Gore Range, and along the Laramie River area.

Site Characteristics: Elevational Range -- 2,550m to 2,850m
Aspect Range -- southerly but variable
Slope % Range -- 7% to 56%
Topographic Position -- gently to moderately sloping surfaces of high mountains on coarser soils and steeper slopes than *PICO/CAGE* h.t.

Soil Characteristics: Shallow to moderately deep, well drained and moderately permeable soils typically with a thin layer of forest litter (5 cm) covering brown, very gravelly, sandy loam surface layer about 8 cm thick. The subsurface layer is gray, extremely cobbly, sandy loam approximately 15 cm thick over a light gray, extremely cobbly, sandy loam substratum of granite, schist, and occasionally sandstone origins. Coarse fragment content is variable but greater than for *PICO/CAGE*. The pH of the A horizons ranges between 5.4 and 6.0.

Soil Families: clayey-skeletal mixed typic Cryoboralfs; loamy-skeletal mixed typic Cryochrepts; coarse-loamy and loamy-skeletal mixed typic Cryoboralfs.

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

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[1] Data given are either averages or encompass the variations found in both the Arapaho-Roosevelt and White River National Forests.

Pinus contorta/Vaccinium scoparium h.t. (*PICO/VASC* h.t.)

Plant Association: Submesic, high elevation forests characterized by a dominance of *Pinus contorta* in the tree stratum and by *Vaccinium scoparium* in the shrub layer; and rather low species diversity, a relatively closed tree canopy, and moderate shrub canopy coverage. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus contorta* and *Picea engelmannii*.
Shrub Stratum *Vaccinium scoparium* (37%), *Juniperus communis* (3%) and *Rosa woodsii* (t).
Herbaceous Stratum
Graminoids: *Carex rossii* (t).
Forbs: *Lupinus argenteus* (1%), *Astragalus miser* (t), *Epilobium angustifolium* (t), and *Solidago ciliosa* (t).

Distribution: Common habitat type found mostly east of the Continental Divide in the Arapaho and Roosevelt National Forests near the upper limits of the *Pinus contorta* series.

Site Characteristics: Elevational Range -- 2,750m to 3,075m
Aspect Range -- southeast to southwest
Slope % Range -- 14% to 31%
Topographic Position -- moderately to steeply sloping high mountains on southerly exposures; at highest elevations on exposed windy and sunny surfaces similar to *PIFL/CAPU* h.t.

Soil Characteristics: Shallow, coarse textured A horizons and extremely skeletal C horizons are typical. Coarse fragment content of A horizons exceeds 35%. The pH of the A horizon varies between 5.4 and 6.0.

Soil Families: loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

Pinus cortorta/Carex geyeri h.t. (*PICO/CAGE* h.t.)[1]

Plant Association: Submesic, high elevation forests distinguished by dominance of *Pinus contorta* in the tree layer and by *Carex geyeri* in the herbaceous stratum; and by moderate species diversity, a closed tree canopy, and moderate to rather high canopy coverage in the understory. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus contorta*.
Shrub Stratum -- *Juniperus communis* (1%), *Arctostaphylos uva-ursi* (6%), *Rosa woodsii* (2%), and *Berberis repens* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (27%).
Forbs: *Campanula rotundifolia* (t), *Lupinus argenteus* (1%), *Epilobium angustifolium* (t), *Arnica cordifolia* (2%), and *Vicia americana* (6%).

Distribution: Locally abundant, forested habitat type chiefly found in and near Middle Park and on the Gore Range; mostly west of the Continental Divide.

Site Characteristics: Elevational Range -- 2,500m to 2,800m
Aspect Range -- varied
Slope % Range -- 0% to 25%
Topographic Position -- level to gently sloping terrain at stated elevations on varied exposures.

Soil Characteristics: Moderately deep (30-70 cm) solums of variable fine to coarse texture composed of distinct albic A horizons and variable B horizons with or without argillic layers. A thin layer of forest litter usually covers the surface. Coarse fragment content is highly variable. The pH of the A horizon varies between 5.4 and 6.4.

Soil Families: fine-loamy mixed Typic Cryoboralf (Arapaho-Roosevelt);
coarse-loamy mixed Typic Cryoboralf
loamy-skeletal mixed Typic Cryoboralf
loamy-skeletal mixed Typic Cryochrept
(White River National Forest).

Source Reference: Hess (1981) and Hess and Wasser (1982).

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[1] Data given are either averages or encompass the variation found in both Arapaho-Roosevelt and White River National Forests.

Pinus contorta/Poa nervosa h.t. (*PICO/PONE* h.t.)

Plant Association: Coniferous forest dominated by *Pinus contorta*; occassionally mixed with seral *Pinus flexilis*; *Poa nervosa* dominant in the understory. Moderate species diversity and cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum -- *Pinus contorta* and *Pinus flexilis* (no cover data trees).
Shrub Stratum -- *Shepherdia canadensis* (3%) and *Juniperus communis* (3%).
Herbaceous Stratum
Graminoids: *Poa nervosa* (4%) and *Trisetum montanum* (1%).
Forbs: *Arnica cordifolia* (9%), *Astragalus miser hylophilus* (5%), *Epilobium angustifolium* (2%), and *Antennaria rosea* (2%).

Distribution: Extensively occurring habitat type found throughout the Wind River Mountains, particularily in the southern third bordering expansive desert steppes. *Pinus contorta* series well represented in Wyoming, Montana, and Colorado.

Site Characteristics: Elevational Range -- 2,400m to 2,900m
Aspect Range -- variable
Slope % Range -- variable
Topographic Position -- recorded but not published

Soil Characteristics: Profile descriptions provided in dissertation, otherwise not published.

Soil Families: Information not available

Source Reference: R.M. Reed (1969;1976).

Geographic Reference: Shoshone and Bridger National Forests.

Pinus flexilis/Calamagrostis purpurascens h.t. (*PIFL/CAPU* h.t.)

Plant Association: Semixeric, high elevation forests dominated by *Pinus flexilis* in the tree stratum and by *Calamagrostis purpurascens* in the herb layer; and typified by relatively low species diversity and canopy coverage. A partial list of species wigh high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus flexilis*.
Shrub Stratum -- none.
Herbaceous Stratum
Graminoids: *Calamatrostis purpurascens* (11%), *Carex rossii* (1%), *Poa rupicola* (t).
Forbs: *Arenaria fendleri* (2%), *Erigeron pinnatisectus* (1%), *Pulsatilla ludoviciana* (1%), *Erigeron compositus* (t), *Frasera speciosa* (t), *Mertensia viridis* (t), *Potentilla pulcherrima* (t), and *Sedum stenopetalum* (t).

Distribution: Minor but widely distributed forest habitat type; locally abundant along the eastern flanks of the Front Range on exposed ridgetops and upper slopes.

Site Characteristics: Elevational Range -- 2,950m to 3,350m
Aspect Range -- southwest to northwest
Slope Range -- 14% to 31%
Topographic Position -- exposed, windswept ridgetops and upper slope positions of westerly exposures and moderate inclinations. Often quite rocky but less bouldery than the *PIFL/JUCO* h.t.

Soil Characteristics: Thin (4-11 cm), coarse textured A horizons overly shallow C horizons which abut fractured bedrock at depths varying between 20 and 30 cm. Bedrock is composed of granitic, schistic, and gneissic rocks. Coarse rock fragment of the A and C horizons exceeds 35%. The pH of the A horizon ranges from 6.2 to 6.8. Exposed rock, gravel, and to lesser extent bare soils are conspicuous features of the soil surfaces.

Soil Families: sandy-skeletal mixed Typic Cryorthents;
loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus flexilis/Juniperus communis h.t. (*PIFL/JUCO* h.t.)

Plant Association: Semixeric, middle to high elevation forests dominated by *Pinus flexilis* in the tree layer and by *Juniperus communis* in the shrub layer; relatively low species diversity and canopy coverage. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum -- *Pinus flexilis* and *Pinus contorta*.
Shrub Stratum *Juniperus communis* (17%) and *Arctostaphylos uva-ursi* (5%).
Herbaceous Stratum
Graminoids: *Carex rossii* (1%) and *Calamagrostis purpurascens* (1%).
Forbs: *Sedum stenopetalum* (t), *Arenaria fendleri* (t), *Draba stroptocarpa* (t), *Erigeron compositus* (t), *Geranium fremontii* (t), *Harbouria trachypleura* (t), *Penstemon virens* (t), and *Thermopsis divaricarpa* (t).

Distribution: Minor but widespread forestland habitat type found throughout the Arapaho and Roosevelt National Forests, most commonly on exposed, windswept ridges and upper slopes of variable exposures and moderate inclinations.

Site Characteristics: Elevational Range -- 2,575m to 2,900m
Aspect Range -- variable
Slope % Range -- 12% to 41%
Topographic Position -- exposed, windswept ridgetops and upper slope positions of variable exposures and moderate inclinations.

Soil Characteristics: Thin, skeletal solums derived from parent materials of igneous and metamorphic residuum and colluvium characterized by coarse textured, shallow (7-9 cm) A horizons overlying an extremely rocky to near massive C horizon. Lithic contact may be 50 cm or more below the soil surface. Coarse fragment content is high and pH is 6.2 to 6.8 for A horizon. Bare soil and gravel dominate the soil surface.

Soil Families: loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus flexilis/Trifolium dasyphyllum h.t. (*PIFL/TRDA* h.t.)

Plant Association: Xeric, high elevation forests characterized by dominance of *Pinus flexilis* in the tree stratum and by *Thermopsis divaricarpa* in the herb layer; and by relatively high species diversity and moderate canopy coverage most evident in the herb layer. A partial list of species iwth high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus flexilis* and *Picea engelmannii*.
Shrub Stratum -- *Juniperus communis* (1%) and *Potentilla fruticosa* (t).
Herbaceous Stratum
Graminoids: *Calamagrostic purpurascens* (1%), *Carex foenea* (1%), *Festuca brachyphylla* (1%), *Agropyron scribneri* (1%), *and Carex elynoides* (1%).
Forbs: *Trifolium dasyphyllum* (32%), *Arenaria fendleri* (2%), *Mertensia viridis* (2%), *Geum rossii* (1%), *Oreoxis alpina* (1%), *Polemonium delicatum* (1%), *Saxifraga bronchialis* (1%), and *Sedum stenopetalum* (1%).

Distribution: Minor but highly visible forested habitat type at or just below treeline and at the interface between alpine tundra and subalpine forests in both the Arapaho and Roosevelt National Forests.

Site Characteristics: Elevational Range -- 3,368m to 3,490m
Aspect Range -- southerly to southwesterly
Slope % Range -- 33% to 54%
Topographic Position -- moderately steep, south to southwesterly exposures of high mountain slopes at the interface between subalpine forest and alpine tundra.

Soil Characteristics: Minimally developed entisols characterized by shallow (6-15 cm), coarse textured A horizons and very rocky C horizons. Coarse fragment content frequently exceeds 40%. The pH of the A horizon varies between 5.4 and 6.8. Parent materials typically are granitic.

Soil Families: loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

Pinus aristata/Trifolium dasyphyllum h.t. (*PIAR/TRDA* h.t.)

Plant Association: Semixeric, very high elevation forests characterized by a dominance of *Pinus aristata* in the tree stratum and by *Trifolium dasyphyllum* in the herb layer; and by a moderately closed canopy in the tree layer, a weakly moderate species diversity, and a rather sparse canopy coverage of the understory vegetation. A partial list of species with high constance follows (% canopy coverage for nontree species in parentheses):

Tree Stratum -- *Pinus aristata* and *Picea engelmannii*.
Shrub Stratum -- *Potentilla fruticosa* (t).
Herbaceous Stratum
Graminoids: *Carex foenea* (2%), *Carex elynoides* (1%), *Calamagrostis purpurascens* (t), and *Trisetum spicatum* (t).
Forbs: *Trifolium dasyphyllum* (11%), *Penstemon whippleanus* (2%), *Achillea lanulosa* (1%), *Polemonium delicatum* (1%), *Sedum stenopetalum* (1%), *Arenaria fendleri* (t) *Allium geyeri* (t), *Artemisia scopulorum* (t), *Epolobium angustifolium* (t), and *Solidago decumbens* (t).

Distribution: Minor forest habitat type found just below treeline in the far southern Arapaho National Forest chiefly adjacent to Mount Evans.

Site Characteristics: Elevational Range -- 3,425m to 3,550m
Aspect Range -- variable
Slope % Range -- 26% to 47%
Topographic Position -- variably exposed high mountain slopes at interface between subalpine forests and alpine tundra, uniquely exposed to desiccating winds.

Soil Characteristics: Minimally developed Entisols developed from granitic parent materials typified by shallow, coarse textured A horizons and relatively rocky C horizons. Coarse fragment content of the A horizon is moderate but variable and the pH is 5.6 to 6.2.

Soil Families: loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Arapaho National Forest.

Pinus albicaulis/Vaccinium scoparium h.t. (*PIAL/VASC* h.t.)

Plant Association: Patchy coniferous forest groves near upper timberline; dominated by *Pinus albicaulis* and *Pinus flexilis*; *Vaccinium scoparium* is the principal understory shrub. Low species diversity and cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum -- *Pinus albicaulis* and *Pinus flexilis* (no cover data for trees).
Shrub Stratum -- *Vaccinium scoparium* (no cover data available).
Herbaceous Stratum
Graminoids: *Poa nervosa* (6%).
Forbs: *Arnica cordifolia* (4%).

Distribution: Extensive, mostly grove-like habitat type on exposed ridges near upper timberline along the continental divide in the Wind River Mountains and elsewhere in the northern Rocky Mountains.

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Site Characteristics: Elevational Range -- 2,900m to 3,200m
Aspect Range -- variable
Slope % Range -- recorded but not published
Topographic Position -- exposed, rocky, high mountain ridges near crests of high mountains.

Soil Characteristics: Weakly developed, shallow, coarse textured soils; typically only about 30cm deep. Horizon sequence: A1/AC or B/C/R. Surface soil is sandy loam, subsoil is gravelly sand; nutrient status similar to *PIEN/VASC* h.t.; moderately acid (pH 5.1).

Soil Families: Information not available. Complete soil descriptions given in reference.

Source Reference: R.M. Reed (1969; 1976).

Geographic Reference: Shoshone National Forest.

Picea engelmannii/Vaccinium scoparium h.t. (*PIEN/VASC* h.t.)
(B)

Plant Association: Conifer forest grading to krummholz near upper timberline; dominated by *Picea engelmannii* except for two stands dominated by *Abies lasiocarpa* reproduction; *Vaccinium scoparium* principal shrub component. Low species diversity and low herbaceous cover. A partial list of species with high constancy follows (% canopy coverage -- except for trees -- in parentheses):

Tree Stratum -- *Picea engelmannii* and *Abies lasiocarpa*.
Shrub Stratum -- *Vaccinium scoparium* (41%).
Herbaceous Stratum
Graminoids: *Poa nervosa* (1%) and *Carex rossii* (1%).
Forbs: *Arnica cordifolia* (6%), *Epilobium angustifolium* (2%), and *Antennaria rosea* (1%).

Distribution: Small stands comprise an extensive and widely distributed habitat type, occurring primarily along the spine of the continental divide in the Wind River Mountains and elsewhere just below upper timberline where more commonly recognized or designated as the *Picea-Abies/Vaccinium* habitat type.

Site Characteristics: Elevational Range -- 2,600m to 3,200m
Aspect Range -- variable
Slope % Range -- recorded but not published
Topographic Position -- steeply sloping, mountainous upland terrain; mostly upper slope positions of high mountains.

Soil Characteristics: Moderately shallow soils; none over 50cm deep exhibiting signs of podsolization; A2 horizon common, occassionally associated with well developed B2ir horizon. Easily recognized in the field by weakly developed angular blocky structure of B2. Horizon sequence: A2/B2/C/R. Silt loam surface and sandy loam subsoils; moderately acid A horizon (pH 5.0). Relatively high exchange capacity and moisture equivalence due to high organic matter content of soil.

Soil Families: Information not available. Soil profile descriptions given.

Source Reference: R.M. Reed (1969; 1976).

Geographic Reference: Shoshone National Forest.

Special Note: This habitat type appears to be very similar to the *PIEN-ABLA/VASC* h.t. of the Arapaho, Roosevelt, and White River National Forests and, as such, should properly be included in that habitat type. Its inclusion as a separate listing reflects geographical separation -- not necessarily ecological separation. Also, see *ABLA/PONE* h.t.

Picea engelmannii/Trifolium dasyphyllum h.t. (*PIEN/TRDA* h.t.)[1]

Plant Association: Submesic, very high elevation forests characterized by dominance of *Picea engelmannii* in the tree layer and by *Trifolium dasyphyllum* in the herb stratum; and by a closed tree canopy; rather low species diversity and sparse canopy coverage of the understory layers. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea engelmannii* and *Abies lasiocarpa*.
Shrub Stratum -- *Vaccinium scoparium* (t).
Herbaceous Stratum
Graminoids: *Trisetum spicatum* (t) and *Festuca brachyphylla* (t).
Forbs: *Trifolium dasyphyllum* (6%), *Trifolium parryi* (3%), *Pyrola minor* (1%), *Arenaria fendleri* (t), and *Sedum stenopetalum* (t).

Distribution: Minor habitat type found in most areas of the Arapaho-Roosevelt National Forest in a narrow zone immediately below the *PIEN-ALBA/SAPS* h.t.

Site Characteristics: Elevational Range -- 3,300m to 3,450m
Aspect Range -- north to northwest
Slope % Range -- 22% to 42%
Topographic Position -- mostly convex to undulating surface relief of moderately steep northfacing mountain slopes.

Soil Characteristics: Soils exhibit minimal profile horizonation and consist of moderately deep litter and humus layers (5-15 cm), shallow (6-24 cm) A horizons, and rocky to skeletal C horizons. They are derived from colluvial parent material of mostly granitic origin. Coarse fragment content is variable. The pH of the A horizon is 5.2 to 5.8.

Soil Families: coarse-loamy mixed Typic Cryorthents;
loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forests.

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[1] May be *Picea engelmannii-Abies lasiocarpa* as originally classed but presence of only outnumbered seedlings and no mature or small diameter stems indicate *Abies* is clearly subdominant.

=Abla-Pien/Vasc

Picea engelmanni-Abies lasiocarpa/Vaccinium scoparium h.t. (*PIEN-ABLA/VASC* h.t.)
(A)

Plant Association: Conifer forest (averaging 266-283 ft^2/acre basal area) dominated by *Picea engelmanni* and *Abies lasiocarpa*; *Vaccinium scoparium* principal component of the shrub layer. Low species diversity and low herbaceous cover. A partial list of species with high constancy follows (% canopy coverage -- excluding trees -- in parentheses):

Tree Stratum -- *Picea engelmanni* and *Abies lasiocarpa*.
Shrub Stratum -- *Vaccinium myrtillus* (6%), and *Vaccinium scoparium* (42%).
Herbaceous Stratum
Graminoids: *Calamagrostis canadensis* (t), and *Carex geyeri* (t).
Forbs: *Arnica cordifolia* (3%), *Arnica latifolia* (1%), *Epilobium angustifolium* (t), *Erigeron* spp. (t), *Fragaria ovalis* (t), *Ligusticum porteri* (1%), *Pedicularis racemosa* (t), and *Pyrola* spp. (t).

Distribution: Major forestland habitat type of the entire subalpine zone; common throughout the north-central Colorado Rocky Mountains; mostly on steeply sloping hillsides except at higher elevations where it extends to more level terrain; found on both sides of the continental divide.

Site Characersitics: Elevational Range -- 2,750m to 3,525m
Aspect Range -- variable
Slope % Range -- 0% to over 70%
Topographic Position -- highly variable; in general, occupies subalpine sites that are well drained and which circumscribe a mesic environment (as compared to the less mesic environments of the *PIEN-ABLA/CAGE* h.t. and of habitat types of the *Pinus contorta* series.

Soil Characteristics: Variably deep, loam to sandy loam, somewhat gravelly and cobbly soils; solum, 35cm to 80cm in depth, characterized by albic A horizons and argillic B horizons (Alfisols) or thin A horizons directly overlying skeletal C horizons (Entisols); coarse fragment content of solum highly variable, generally exceeding 25%. The A-horizon pH varies from 4.6 to 6.6. Sandstone, granite, schist, and gneiss represent the most common parent material.

Soil Families: loamy-skeletal mixed Lithic Cryorthent
loamy-skeletal mixed Typic Cryorthent
loamy mixed Lithic Cryorthent
clayey over sandy mixed Lithic Cryorthent
coarse loamy mixed Typic Cryoboralf

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

Special Note: See *PIEN/VASC* h.t. (B) on an earlier page.

=AbCo-Pien/Pamy

Picea engelmannii-Abies lasiocarpa/Pachystima myrsinites h.t.
(*PIEN-ABLA/PAMY* h.t.)

Plant Association: Mesic, high elevation forests dominated by *Picea engelmannii* and *Abies lasiocarpa* in the tree stratum and by *Pachystima myrsinites* in the low shrub layer; and characterized by a closed upper canopy, low species diversity, moderate canopy coverage of low shrubs and sparse canopy coverage of the herbaceous layer. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea engelmannii, Abies lasiocarpa,* and *Pseudotsuga menziesii.*
Shrub Stratum -- *Pachystima myrsinites* (29%), *Vaccinium scoparium* (2%), *Linnaea borealis* (1%), and *Rosa woodsii* (1%).
Herbaceous Stratum
Forbs: *Arnica cordifolia* (1%), *Erigeron speciosus* (1%), *Aquilegia coerulea* (t), and *Pyrola secunda* (t).

Distribution: Minor forest habitat type locally abundant only in the southern White River National Forest where it occupies the lower elevational range of the *Picea engelmannii-Abies lasiocarpa* Series.

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Site Characteristics: Elevational Range -- 2,750m to 2,925m
Aspect Range -- northerly
Slope % Range -- 62% to 93%
Topographic Position -- steep northerly exposures of the lower elevation *Picea engelmannii--Abies lasiocarpa* forests.

Soil Characteristics: Shallow, well drained, and moderately permeable soils typically have a moderately deep layer of forest litter covering a brown, very gravelly loam surface soil of about 15 cm thickness. The subsurface layer is light yellowish brown, extremely cobbly, clay loam about 50 cm thick over an extremely stony, colluvial substratum of mixed sandstone and limestone origins. Solum pH varies from 6.0 to 6.8. Coarse fragment content is highly variable but may be quite high.

Soil Families: loamy-skeletal mixed Typic Cryorthents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

= Picea/Saps

Picea engelmannii-Abies lasiocarpa/Salix pseudolapponum h.t. (*PIEN-ABLA/SAPS* h.t.)[1]

Plant Association: Mesic, very high elevation krummholz vegetation codominated by dwarfed *Picea engelmannii* and *Abies lasiocarpa* in the uppermost stratum and by *Salix pseudolapponum* in the shrub layer; and having a semi-closed, dwarf tree canopy; rather high species diversity but only moderate canopy coverage below the dwarfed trees. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea engelmannii* and *Abies lasiocarpa*.
Shrub Stratum -- *Salix pseudolapponum* (20%), and *Vaccinium scoparium* (8%).
Herbaceous Stratum
Graminoids: *Calamagrostic purpurascens* (t), *Festuca brachyphylla* (t), *Luzula* spp. (t), and *Trisetum spicatum* (t).
Forbs: *Artemisia scopulorum* (1%), *Geum rossii* (2%), *Polemonium delicatum* (6%), and *Potentilla diversifolia* (t).

Distribution: Common dwarf and bent timber habitat type found in all three National Forests integrated herein at the highest extensions of the *Picea engelmannii* series.

Site Characteristics: Elevational Range -- 3,450m to 3,600m
Aspect Range -- variable but mostly northerly
Slope % Range -- 15% to 40%
Topographic Position -- exposed, windswept, moderately sloping, high mountain hillsides usually of west to north exposures.

Soil Characteristics: Soils are very shallow and skeletal. Typically a moderately thick layer of litter covers a yellowish brown, gravelly loam surface soil about 10 cm thick. The subsurface layer is light yellowish brown, very gravelly, sandy loam approximately 33 cm thick over bedrock of mostly granite and schist composition. Coarse fragment content usually is high. The pH of the A horizon is 4.6 to 5.4.

Soil Families: sandy-skeletal mixed Typic Cryorthents;
loamy-skeletal mixed Typic Cryorthents;
loamy-skeletal mixed Lithic Cryorthents.

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho-Roosevelt and White River National Forests.

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[1] Data given are either averages or encompass the variation found in these forests.

=Abla-Pien/Cage

Picea engelmannii-Abies lasiocarpa/Carex geyeri h.t.
(*PIEN-ABLA/CAGE* h.t.)

Plant Association: Mesic, very high elevation forests dominated by both *Picea engelmannii* and *Abies lasiocarpa* in the tree stratum and by *Carex geyeri* in the herbaceous stratum and having a closed upper tree canopy; moderate to high species diversity and moderate canopy coverage in the herbaceous layers. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea engelmannii* and *Abies lasiocarpa*.
Shrub Stratum -- *Pachystima myrsinites* (2%), *Rosa woodsii* (1%), and *Vaccinium scoparium* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (26%).
Forbs: *Arnica cordifolia* (2%), *Lathyrus leucanthus* and *Vicia americana* (combined) (2%), and *Thalictrum fendleri* (t).

Distribution: Major habitat type commonly found near upper treeline in western portions of Arapaho National Forest, in the far southwestern corner of the White River National Forest, and on the White River Plateau.

Site Characteristics: Elevational Range -- 2,750m to 3,255 m
Aspect Range -- variable
Slope % Range -- 10% to 54%
Topographic Position -- gentle to moderate slopes with varied exposures but when on south exposures on exposed, steeply sloping surfaces.

Soil Characteristics: Typically the solum is covered by a thin layer of forest litter which overlies a brown, very gravelly loamy surface layer about 15 cm thick. The substratum is yellowish brown, extremely cobbly loam approximately 45 cm thick of sedimentary or volcanic origin. The pH of the A horizon varies between 5.4 and 6.4.

Soil Families: fine-loamy mixed Typic Cryoboralfs;
loamy-skeletal mixed Typic Cryochrepts.

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

= Abla-Picea/Caca

Picea engelmannii-Abies lasiocarpa/Calamagrostis canadensis h.t.
(*PIEN-ABLA/CACA* h.t.)

Plant Association: Semihydric, high elevation forests dominated by *Picea engelmannii* and *Abies lasiocarpa* in the tree layer and by *Calamagrostis canadensis* in the herbaceous stratum; and having a moderately open low tree canopy; high species diversity and moderately high canopy coverage of understory vegetation. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea engelmannii* and *Abies lasiocarpa*.
Shrub Stratum -- *Lonicera involucrata* (2%) and *Ribes lacustre* (2%).
Herbaceous Stratum
Graminoids: *Calamagrostis canadensis* (33%), *Carex aquatilis* (10%), *Carex disperma* (1%), *Carex festivella* (t), *Carex media* (t), *Luzula parviflora* (1%), and *Poa reflexa* (t).
Forbs: *Equisetum arvense* (10%), *Saxifraga arguta* (8%), *Senecio triangularis* (2%), *Smilacina stellata* (2%), *Caltha leptosepala* (3%), *Mertensia ciliata* (2%), *Aconitum columbianum* (1%), *Arnica cordifolia* (1%), *Epilobium angustifolium* (1%), *Mitella petandra* (1%), *Osmorhiza depauperata* (1%), and *Pyrola chlorantha* (1%).

Distribution: Minor but widely distributed habitat type of high elevation *Picea engelmannii* forests which occur in the Arapaho-Roosevelt National Forests.

Site Characteristics: Elevational Range -- 2,750m to 3,050m
Aspect Range -- north to easterly
Slope % Range -- 0% to 10%
Topographic Position -- level to nearly-level benches elevated above streams and bordered by inclined mountain slopes that result in a near hydric site due to snow accumulation.

Soil Characteristics: Variable depth solums of loam to silt loam texture with dark, mollic epipedons and weakly expressed cambic B horizons. Parent materials alluvial and fluvial of mixed mineralogy. Low to moderate coarse fragment content; pH of the A horizon is 6.0 to 6.6.

Soil Families: loamy-skeletal and coarse-loamy mixed Typic Cryaquolls.

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forests.

=Abla-Pien/Setr

Picea engelmannii-Abies lasiocarpa/Senecio triangularis h.t.
(*PIEN-ABLA/SETR* h.t.)

Plant Association: Hypermesic, very high elevation forests characterized by a dominance of *Picea engelmannii* and *Abies lasiocapra* in the tree layer and by *Senecio triangularis* in the herb stratum; and by a moderately closed tree canopy, high species diversity and relatively moderate canopy coverage of the low shrub and herb layers. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Picea engelmannii* and *Abies lasiocarpa*.
Shrub Stratum -- *Vaccinium scoparium* (4%) and *Vaccinium myrtillus* (2%).
Herbaceous Stratum
Graminoids: *Calamagrostis canadensis* (1%), *Carex aquatilis* (1%), *Carex disperma* (t), and *Luzula parviflora* (t).
Forbs: *Senecio triangularis* (24%), *Caltha leptosepala* (10%), *Arnica cordifolia* (5%), *Trolius laxus* (3%), *Mertensia ciliatus* (1%), *Mitella petandra* (1%), *Moneses uniflora* (1%), *Osmorhiza depauperata* (1%), and *Veronica wormsjoldii* (1%).

Distribution: Minor forested habitat type found along snow meltwater drainageways in the Arapaho-Roosevelt National Forest.

Site Characteristics: Elevational Range -- 2,950m to 3,400m
Aspect Range -- variable
Slope % Range -- 12% to 52%
Topographic Positions -- elongated concave sloping surfaces that are inundated by snowmelt runoff in early summer but remain near field capacity summerlong.

Soil Characteristics: Solum characteristics vary greatly except for their skeletal nature. A distinct A horizon is present with or without a cambic or argillic B horizon. The sandy loam to silt loam texture of the solum varies from 21 to over 88 cm in depth. Parent materials are alluvium and colluvium of gneiss, schist, and granitic origin. pH of the A horizon is 5.4 to 6.0.

Soil Families: loamy-skeletal mixed Typic Cryoboralfs;
loamy-skeletal mixed Entic Cryumbrepts;
loamy-skeletal mixed Aquic Cryumbrepts.

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forests.

Abies lasiocarpa/Carex geyeri h.t. (*ABLA/CAGE* h.t.)

Plant Association: Mesic, very high elevation forests characterized by a dominance of *Abies lasiocarpa* in the tree stratum and by *Carex geyeri* in the herbaceous layer; and relatively high species diversity, a closed tree canopy, and moderate canopy coverage of herbaceous species. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Abies lasiocarpa* and *Populus tremuloides*.
Shrub Stratum -- *Symphoricarpos oreophilus* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (49%), *Agropyron trachycaulum* (t), *Bromus ciliatus* (t), and *Elymus glaucus* (t).
Forbs: *Geranium richardsonii* (1%), *Ligusticum porteri* (1%), *Thalictrum fendleri* (1%), *Archillea lanulosa* (t), *Aquilegia coerulea* (t), *Fragaria ovalis* (1%), *Galium boreale* (1%), *Aster* spp. (t), *Helenium hoopesii* (t), *Osmorhiza obtusa* (t), *Vicia americana* (1%), and *Viola* spp. (t).

Distribution: Common forested habitat type occupying a narrow landscape zone encircling the White River Plateau.

Site Characteristics: Elevational Range -- 2,750m to 2,975m
Aspect Range -- southwest to northwest
Slope % Range -- 10% to 28%
Topographic Position -- exposed subalpine mountain slopes with moderate soil depths.

Soil Characteristics: A moderately deep (6 cm) layer of forest duff covers a brown, extremely gravelly loamy surface soil about 23 cm thick. The subsurface is brown, extremely cobbly loam about 18 cm thick. Yellowish brown substratum about 12 cm thick covers bedrock of pyroclastic, sandstone, or siltstone composition. pH of A horizon is 5.2 to 7.2.

Soil Families: loamy-skeletal mixed Typic Cryoborolls; loamy-skeletal mixed Lithic Cryoborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Abies lasiocarpa/Poa nervosa h.t. (*ABLA/PONE* h.t.)

Plant Association: Coniferous forest dominated by vigorously reproducing *Abies lasiocarpa* with some stands having *Picea engelmanni* as minor associate; *Poa nervosa* recorded as principal understory species. Moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum -- *Abies lasiocarpa* (no cover data for trees).
Shrub Stratum -- *Vaccinium scoparium* (7%) and *Shepherdia canadensis* (4%).
Herbaceous Stratum
Graminoids: *Poa nervosa* (4%) and *Trisetum spicatum* (3%).
Forbs: *Arnica cordifolia* (17%), *Fragaria* spp. (4%), *Epilobium angustifolium* (2%), *Aquilegia caerulea* (1%).

Distribution: A major and widely distributed habitat type found at elevations intermediate to the *PSME/SYOR* h.t. (below) and the *PIEN/VASC* h.t. (above); common throughout the Wind River Mountains and elsewhere in Wyoming and adjacent states.

Site Characteristics: Elevational Range -- 2,400m to 3,000m
Aspect Range -- variable; generally north
Slope % Range -- recorded but not published
Topographic Position -- variable, mountainous uplands, mostly on sloping, rocky convex surfaces of intermediate slope positions.

Soil Characteristics: Solum depth up to 60cm; silt loam surface and sandy loam subsoil with A/B/C horizon sequence; granite parent material. Soil moderately acid (pH 5.6); lower exchange capacity and exchangeable cations than the *PSME/SYOR* h.t. due to higher position on the moisture-temperature gradient.

Soil Families: Information not available. Soil profile descriptions given.

Source Reference: R.M. Reed (1969; 1976).

Geographic Reference: Shoshone National Forest.

Special Note: Reviewer finds some discrepancy between the 1969 thesis and the 1976 article; question arises as to why the above habitat type should not be merged with the *PIEN/VASC* h.t. as a phase. In addition, the thesis appears to have designated this as the *Abies lasiocarpa/Pyrola secunda* habitat type.

Juniperus osteosperma/Cercocarpus montanus-Peraphyllum ramosissimum h.t. (*JUOS/CEMO-PERA* h.t.)

Plant Association: Semixeric, low mountain elevation woodlands characterized by a dominance of *Juniperus osteosperma* in the tree stratum and co-dominance of *Cercocarpus montanus* and *Peraphyllum ramosissimum* in the shrub layer; a low, open tree canopy; low species diversity; and sparse canopy coverage of undercover vegetation. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Juniperus osteosperma* and *Pinus edulis*.
Shrub Stratum -- *Peraphyllum ramosissimum* (6%), *Cercocarpus montanus* (5%), *Quercus gambelii* (3%), *Symphoricarpos oreophilus* (1%), and *Amelanchier utahensis* (t).
Herbaceous Stratum
Graminoids: *Oryzopsis hymenoides* (2%), *Bromus tectorum* (1%), and *Sitanion hystrix* (t).
Forbs: *Eriogonum microthecum* (t) and *Physaria australis* (t).

Distribution: Common woodland habitat type found in lower elevation sites of the southwestern White River National Forest and along lower elevation perimeters of the White River Plateau.

Site Characteristics: Elevational Range -- 1,950m to 2,340m
Aspect Range -- southerly
Slope % Range --18% to 68%
Topographic Position -- lowest forested elevations on southerly exposed, lower mountain slopes.

Soil Characteristics: The shallow, well drained and moderately permeable soils typically have a grayish brown clay surface layer about 12 cm thick. Interbedded shale and sandstone are found at about 20 cm. The pH of the A horizon is 7.4 to 8.4.

Soil Families: clayey mixed frigid shallow Typic Ustorthents;
clayey-skeletal mixed frigid Typic Ustorthents;
loamy mixed frigid Lithic Ustorthents; and
clayey mixed frigid Vertic Ustorthents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Juniperus scopulorum/Artemisia tridentata h.t. (*JUSC/ARTR* h.t.)

Plant Association: Semi-xeric, medium elevation woodlands dominated by *Juniperus scopulorum* in the tree stratum and by *Artemisia tridentata* in the shrub layer; and which have a moderately open tree and shrub cover, moderate species diversity, and rather low canopy coverage most pronounced in forbs. A partial list of species with high constancy follows (% canopy coverage of subdominants in parentheses):

Tree Stratum -- *Juniperus scopulorum*.
Shrub Stratum -- *Artemisia tridentata* (21%), *Ribes cereum* (1%), *Artemisia frigida* (1%), *Leptodactylon pungens* (1%), and *Opuntia polyacantha* (1%).
Herbaceous Stratum
Graminoids: *Elymus ambiguus* (4%), *Carex rossii* (2%), *Oryzopsis micrantha* (2%), *Stipa comata* (2%), *Bouteloua gracilis* (1%), and *Oryzopsis hymenoides* (1%).
Forbs: *Penstemon virens* (1%) and *Potentilla fissa* (1%).

Distribution: Minor woodland habitat type of the montane zone; common on rock and boulder outcroppings of steep to very steep, southerly exposed mountain slopes. Locally abundant in the northern Roosevelt National Forest.

Site Characteristics: Elevational Range -- 2,400m to 2,600m
Aspect Range -- southerly quadrants
Slope % Range --44% to 77%
Topographic Position -- on rocky and boulder outcroppings of steep to very steep, southerly exposed mountain slopes

Soil Characteristics: Shallow to moderately deep, coarse textured A horizons overlying skeletal C horizons. Parent materials primarily gneisses, and schists of colluvial and residual origins. Coarse fragment content of solums exceed 50%. The pH of the A horizons are 7.0 to 7.6.

Soil Families: loamy-skeletal mixed frigid Typic Ustorthents on steeper terrain, and loamy-skeletal mixed frigid Entic Haploborolls.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Juniperus scopulorum/Cercocarpus montanus h.t. (*JUSC/CEMO* h.t.)

Plant Association: Semixeric, lower mountain elevation woodlands dominated by *Juniperus scopulorum* in the tree layer and *Cercocarpus montanus* in the shrub stratum; and which has an open and low tree overstory, moderately high species diversity, and moderately low shrub and low herb canopy coverage. A partial list of species of high species constancy follows (% canopy cover of subdominant species in parentheses):

Tree Stratum -- *Juniperus scopulorum*.
Shrub Stratum -- *Cercocarpus montanus* (20%), *Ribes cereum* (1%), *Artemisia frigida* (1%), and *Opuntia polyacantha* (1%).
Herbaceous Stratum
Graminoids: *Bouteloua gracilis* (3%), *Agropyron griffithsii* (2%), *Stipa comata* (2%), and *Poa sandbergii* (1%).
Forbs: *Potentilla fissa* (2%), *Heuchera bracteata* (1%), *Penstemon virens* (1%), *Eriogonum alatum* (1%), and *Helianthus pumilus* (1%).

Distribution: Minor woodland habitat type of the lower montane zone; common on exposed rock and boulder outcroppings of steep, mostly north facing terrain; found in all forest districts of the Roosevelt National Forest and more prominent in the Front Range.

Site Characteristics: Elevational Range -- 1,875m to 2,125m
Aspect Range -- northeasterly to southwesterly
Slope % Range -- 44% to 64%
Topographic Position -- exposed, steeply inclined and rocky or bouldery terrain; mostly on lower slopes of higher mountains

Soil Characteristics: Shallow, coarse textured Entisol soils derived from colluvial and residual parent materials of gneiss, schist, and granitic minerology. Coarse fragment content exceeds 30% in A horizon. Latter is 7 to 18 cm thick and underlain by a variable depth C horizon. The pH of the A horizon ranges from 6.6 to 7.2.

Soil Families: loamy-skeletal mixed mesic Lithic Ustorthents;
sandy-skeletal mixed mesic Typic Ustorthents;
loamy-skeletal frigid Lithic Ustorthents;
sandy-skeletal frigid Lithic Ustorthents.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Juniperus scopulorum/Purshia tridentata h.t. (*JUSC/PUTR* h.t.)

Plant Association: Semixeric, intermediate-elevation woodlands dominated by *Juniperus scopulorum* in the tree layer and by *Purshia tridentata* in the shrub layer; and further characterized by having a moderately spaced tree cover and widely scattered shrubs, relatively high species diversity but low canopy coverage. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Juniperus scopulorum* and *Pseudotsuga menziesii*.
Shrub Stratum -- *Purshia tridentata* (19%) and *Rubus deliciosus* (1%).
Herbaceous Stratum --
Graminoids: *Carex rossii* (4%), *Agropyron griffithsii* (3%), *Bouteloua gracilis* (3%), *Muhlenbergia montana* (1%), *Hesperochloa kingii* (1%), and *Elymus ambiguus* (1%).
Forbs: *Helianthus pumilus* (3%), *Potentilla fissa* (2%), *Artemisia ludoviciana* (1%), *Chrysopsis villosa* (1%), *Eriogonum umbellatum* (1%), *Lesquerella montana* (1%), *and Penstemon virens* (1%).

Distribution: Minor woodland habitat type of the montane zone; common on rock and boulder outcroppings on non-northerly facing, but steeply inclined mountain slopes. Exclusively found in the northern Roosevelt National Forest.

Site Characteristics: Elevational Range -- 2,150m to 2,500m
Aspect Range -- non-northerly
Slope % Range -- 52% to 174%
Topographic Position -- steeply inclined mountain slopes on rock and boulder outcroppings.

Soil Characteristics: Thin, coarse textured A horizons overlying typically skeletal C horizons. Solums of more mesic, higher elevations originated from colluvial and residual parent materials of gneiss and schist origin. Coarse fragment content of solums generally exceed 35%. The pH of the A horizon varies between 6.6 and 6.8. Much exposed rock, gravel, and bare soil on ground surface.

Soil Families: loamy-skeletal mixed frigid Typic Ustorthents on more xeric, lower elevation sites; loamy-skeletal mixed frigid Entic Haploborolls on more mesic, higher elevation sites.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Pinus edulis-Juniperus osteosperma/Cercocarpus montanus h.t.
(*PIED-JUOS/CEMO* h.t.)

Plant Association: Semixeric, lower mountain elevation woodlands characterized by codominance of *Pinus edulis* and *Juniperus osteosperma* in the tree stratum, by *Cercocarpus montanus* in the shrub layer, by a moderately open and low tree canopy, by relatively low species diversity; and by a weakly moderate canopy coverage of shrubs and very sparse canopy coverage of herbs. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus edulis* and *Juniperus osteosperma*.
Shrub Stratum -- *Cercocarpus montanus* (10%), *Amelanchier utahensis* (2%), *Quercus gambelii* (1%), and *Symphoricarpos oreophilus* (t).
Herbaceous Stratum
Graminoids: *Elymus cinereus* (2%).
Forbs: *Physaria australis* (t) and *Senecio multilobatus* (t).

Distribution: Common habitat type prevalent at lower elevations throughout the White River National Forest.

Site Characteristics: Elevational Range -- 2,100m - 2,400m
Aspect Range -- southerly
Slope % Range -- 35% to 75%
Topographic Position -- slopes rising above river drainages and lower elevational perimeters of the White River Plateau.

Soil Characteristics: The shallow, well drained soils of this habitat type typically have a reddish brown, very gravelly sandy loam surface layer about 6 cm thick and a reddish brown, silt loam subsurface about 12 cm thick. Sandstone is found at about 18 cm. The surface layer is moderately alkaline.

Soil Families: loamy, loamy-skeletal, and loamy-skeletal frigid Lithic Ustorthent; loamy-skeletal, mixed frigid Typic Ustorthents; and clayey mixed frigid shallow Typic Ustorthents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

= Pied/Quga

Pinus edulis/Quercus gambelii/Carex geyeri h.t. (*PIED/QUGA/CAGE* h.t.)

Plant Association: Submesic, low mountain elevation woodlands characterized by dominance of *Pinus edulis* in the tree stratum, by *Quercus gambelii* in the shrub layer, and by *Carex geyeri* in the herb layer; a low, open tree canopy; and moderately high species diversity and canopy coverage of the shrubby undergrowth but a relatively sparse cover of herbs. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Pinus edulis* and *Juniperus osteosperma*.
Shrub Stratum -- *Quercus gambelii* (24%), *Amelanchier utahensis* (12%), *Symphoricarpos oreophilus* (9%), and *Cercocarpus montanus* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (4%), *Carex rossii* (t), and *Sitanion hystrix* (t).
Forbs: *Balsamorhiza sagittata* (1%), and *Vicia americana* (t).

Distribution: Minor woodland habitat type found in the White River National Forest.

Site Characteristics: Elevational Range -- 2,100m to 2,400m
Aspect Range -- non-southerly
Slope % Range -- 27% to 72%
Topographic Position -- relatively mesic environments on slopes adjacent to drainages and on lower elevation perimeters of forested mountains.

Soil Characteristics: The moderately deep and well drained soils typically have a layer of oak duff about 6 cm thick covering a dark brown, loam surface layer about 4 cm thick. Subsoil is brown silty clay loam and gravelly silty clay loam about 28 cm thick. Substratum is grayish brown, very gravelly, sandy clay loam of sandstone or limestone origin. A horizon is weakly calcareous and mildly alkaline.

Soil Families: loamy-skeletal mixed and fine-loamy mixed Pachic Haploboroll; fine mixed Vertic Haploborolls; fine mixed frigid Vertic Ustorthents; and loamy mixed frigid Lithic Ustorthents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Quercus gambelii-Prunus virginiana/Amelanchier utahensis/ Pachystima myrsinites h.t. (*QUGA-PRVA/AMUT/PAMY* h.t.)

Plant Association: Mesic, intermediate elevation shrublands typified by codominance of *Quercus gambelii* and *Prunus virginiana* in the tall shrub stratum, *Amelanchier utahensis* in the medium shrub, and *Pachystima myrsinites* in the low shrub layer. They exhibit a closed canopy, weakly moderate species diversity and only a weak understory cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Quercus gambelii* (42%), *Prunus virginiana* (41%), *Amelanchier utahensis* (25%), *Pachystima myrsinites* (23%), *Symphoricarpos oreophilus* (7%), and *Rosa woodsii* (3%).

Herbaceous Stratum

Graminoids: *Carex geyeri* (24%).

Forbs: *Ligusticum porteri* (5%), *Thalictrum fendleri* (1%), *Vicia americana* (3%), *Viola* spp. (1%), *Smilacina stellata* (3%), and *Galium boreale* (1%).

Distribution: Minor shrubland habitat type following the distributional pattern of *QUGA/SYOR/CAGE* h.t. in the White River National Forest.

Site Characteristics: Elevational Range -- 2,300m to 2,450m
Aspect Range -- westerly to northerly
Slope % Range -- 25% to 52%
Topographic Position -- sites occur along drainages on concave relief and at bottom slope positions under site conditions similar to those for *QUGA/SYOR/CAGE* h.t. except at higher elevations.

Soil Characteristics: Deep, well drained, and moderately permeable soils characterized by having a layer of plant litter covering the dark, grayish brown, clay loam surface soil that is about 52 cm thick. Subsoil is dark grayish brown, silty clay loam about 38 cm thick over bedrock of principally sandstone composition. Surface layer is neutral.

Soil Families: fine mixed and fine-loamy mixed Pachic Argiborolls; fine mixed Lithic Argiborolls; fine-loamy mixed Cumulic Haploborolls; and fine-loamy mixed Lithic Haploborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

=Quga/Syor1

Quercus gambelii/Symphoricarpos oreophilus/Carex geyeri h.t.
(*QUGA/SYOR/CAGE* h.t.)

Plant Association: Submesic shrublands typified by dominance of *Quercus gambelii* in the tall shrub stratum, *Symphoricarpos oreophilus* in the medium shrub layer, and by *Carex geyeri* in the herb layer; by a patchily closed shrub canopy, moderately high species diversity, and moderate canopy coverage of herbs. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Quercus gambelii* (54%), *Symphoricarpos orephilus* (28%), and *Amelanchier utahensis* (23%).

Herbaceous Stratum

Graminoids: *Carex geyeri* (42%).

Forbs: *Vicia americana* (9%), *Ligusticum porteri* (4%), *Galium boreale* (1%), *Lathyrus leucanthus* (1%), and *Lupinus ammophilus* (1%).

Distribution: Major shrubland habitat type extensive in the White River National Forest found chiefly south of the White River Plateau and west of the Sawatch Range.

7050 8200

Site Characteristics: Elevational Range -- 2,150m to 2,500m
Aspect Range -- variable
Slope % Range -- 5% to 72%
Topographic Position -- steeply sloping hillsides, upland benches, and well drained lowlands formed by dissecting streams.

Soil Characteristics: Deep, well drained, only slowly permeable soils having a dark grayish brown silty clay loam surface layer about 31 cm thick and a dark grayish brown silty clay loam subsurface layer about 13 cm thick overlying a yellowish brown clay substratum principally of sedimentary origin. The surface layer is neutral in reaction.

Soil Families: fine mixed and clayey skeletal mixed Cumulic Haploborolls and fine mixed Typic Argiborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

= Poan3 / Saex-Beto

Populus angustifolia/Salix exigua h.t. (*POAN/SAEX* h.t.)

Plant Association: Semi-hydric, upper foothill to lower montane deciduous forests dominated by *Populus angustifolia* in the tree layer and by *Salix exigua* in the shrub stratum; and by relatively high species diversity and canopy coverage. A partial list of species with high constancy follows (% canopy coverage for nontree species in parentheses):

Tree Stratum -- *Populus angustifolia* and *Juniperus scopulorum.*
Shrub Stratum -- *Salix exigua* (12%), *Alnus tenuifolia* (7%), *Rosa woodsii* (5%), *Cornus stolonifera* (9%), *Betula occidentalis* (3%), *Salix caudata* (5%), and *Salix monticola* (4%).
Herbaceous Stratum
Graminoids: *Calamagrostis canadensis* (23%), *Poa pratensis* (3%), *Phleum pratense* (1%), *Bromus anomalus* (t), and *Agropyron trachycaulum* (t).
Forbs: *Smilacina stellata* (6%), *Vicia americana* (5%), *Galium boreale* (2%), *Heracleum lanatum* (1%), and *Taraxacum boreale* (1%).

Distribution: Minor woodland habitat type of the upper foothill and lower montane common along main streams flowing through foothills in Front Range.

6560 7790

Site Characteristics: Elevational Range -- 2,000m to 2,375m
Aspect Range -- variable
Slope % Range -- 0% to 4%
Topographic Position -- narrow benches adjacent to smaller mountain streams and on broader floodplains and sandbars of larger streams and rivers which are periodically flooded.

Soil Characteristics: Thin poorly developed soils with deep (33-41cm) sandy loam to loam textured A horizon; C horizon composed of stratified depositional layers often covered by high water table. Coarse fragment content of solum negligible. Soils derived from alluvial and fluvial parent materials of mixed geologic origin. The pH of A horizon variable, 6.2 to 7.4.

Soil Families: coarse-loamy mixed frigid Mollic Ustifluvents;
coarse-loamy mixed frigid Aquic Ustifluvents;
coarse-loamy mixed frigid Mollic fluvaquents.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

= Poan3/Amal

Populus angustifolia/Amelanchier alnifolia/Smilacina stellata h.t.
(*POAN/AMAL/SMST* h.t.)

Plant Association: Mesic, riparian, deciduous woodlands typically dominated by *Populus angustifolia* in the tree layer, by *Amelanchier alnifolia* in the shrub stratum, and by *Smilacina stellata* in the herb layer; further characterized by a tall closed tree canopy, moderate species diversity, relatively high canopy coverage of shrubs but low cover of herbs. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Populus angustifolia* and *Juniperus scopulorum*.
Shrub Stratum -- *Amelanchier alnifolia* (28%), *Rosa woodsii* (6%), *Prunus virginiana* (4%), *Berberis repens* (8%), *Symphoricarpos oreophilus* (4%), *Acer glabrum* (6%), and *Quercus gambelii* (3%).
Herbaceous Stratum
Graminoids: *Poa pratensis* (2%), *Carex geyeri* (2%), *Agropyron trachycaulum* (t).
Forbs: *Smilacina stellata* (7%), *Osmorhiza occidentalis* (2%), *Galium boreale* (1%), *Achillea lanulosa* (t), *Galium aparine* (t), *Taraxacum officinale* (1%), and *Vicia americana* (1%). a/

Distribution: Common and widely distributed habitat type in the White River National Forest.

5900 7870

Site Characteristics: Elevational Range -- 1,800m to 2,400m
Aspect Range -- variable
Slope % Range -- 0% to 7%
Topographic Position -- on narrow benches near small mountain streams and on floodplains of larger streams and rivers.

Soil Characteristics: Moderately to rapidly permeable stratified soils typically having a brown, very gravelly, loamy sand surface layer about 20 cm thick and a brown, extremely gravelly substratum of mixed mineralogical origin. The A horizon is mildly alkaline.

Soil Families: sandy-skeletal mixed frigid Typic Ustifluvent; fine-loamy mixed calcareous Typic Cryofluvent; and sandy mixed frigid and loamy-skeletal mixed frigid calcareous Typic Ustifluvents.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

= Potr1/Coco1-Asla

Populus tremuloides/Corylus cornuta h.t. (*POTR/COCO* h.t.)

Plant Association: Deciduous woodland dominated by *Populus tremuloides*, with *Corylus cornuta* principal species of dense and diverse shrub layer. A partial list of species with high constancy follows (cover-frequency index in parentheses):

Tree Stratum -- *Populus tremuloides* (479AvD in 4-8" dbh class, 73AvD in 8-12" class), *Corylus cornuta* (793AvD).
Shrub Stratum -- *Corylus cornuta* (4617 CFI), *Symphoricarpos albus* (105 CFI), and *Spiraea lucida* (36 CFI).
Herbaceous Stratum
Graminoids: *Oryzopsis asperifolia* (27 CFI) and *Bromus marginatus* (21 CFI).
Forbs: *Aralia nudicaulis* (27 CFI), *Osmorhiza obtusa* (255 CFI), *Aster laevis* (120 CFI) and *Vicia americana* (140 CFI).

Distribution: Minor habitat type occurring in only three stands; two in the northern Black Hills and one in Palmer Gulch.

Site Characteristics: Elevational Range -- 1,646m to 1,829m (5400 6000)
Aspect Range -- variable
Slope % Range -- recorded but not published
Topographic Position -- recorded but not published

Soil Characteristics: Soils derived from quartzitic schists and Tertiary igneous parent material. Soils well developed with a distinct A2 and either a transitional AC or a B1/B2 horizon sequence. Subsoils often saturated with water; seepage evident.

Soil Families: Information not available. See profile data in reference.

Source Reference: Severson and Thilenius (1976), no. AG-8.

Special Note: Association appears to be a fire climax. Although conifer stumps present, old age of *Populus tremuloides* (77-98 yrs.) and natural reoccurrence of fire will likely maintain this particular plant community. Vigorous aspen reproduction noted and contributing to stability of the plant community.

Geographic Reference: Black Hills National Forest.

Populus tremuloides/Ostrya virginiana h.t. (*POTR/OSVI* h.t.)

Plant Association: Mesic, dense deciduous woodland dominated by *Populus tremuloides*; *Ostrya virginiana* both a dominant shrub and a subordinate tree. A partial list of species with high constancy follows-- (cover-frequency index in parentheses):

Tree Stratum -- *Populus tremuloides* (305AvD in 4-8" dbh class, 174AvD in 0-4" dbh class), *Ostrya virginiana* (871AvD).
Shrub Stratum -- *Ostrya virginiana* (5632 CFI), *Symphoricarpos albus* (434 CFI), *Berberis repens* (512 CFI).
Herbaceous Stratum
Graminoids: *Oryzopsis asperifolia* (792 CFI).
Forbs: *Actaea rubra* (600 CFI), *Aster laevis* (220 CFI), and *Smilicina stellata* (184 CFI).

Distribution: Minor habitat type represented by only one stand in the northern Black Hills, South Dakota.

Site Characteristics: Elevational Range -- 1,387m (only one site)
Aspect Range -- south (only one site)
Slope % Range -- recorded but not published
Topographic Position -- lower slope positions and bottoms of deep draws.

Soil Characteristics: Very deep (102cm), well developed soils; derived from limestone parent material; horizon sequence: A1/A2/A3/B2t/R.

Soil Families: Information not available. Profile descriptions accessible from reference.

Source Reference: Severson and Thilenius (1976), no. AG-9; Terwilliger et al (1979), no. 98.

Geographical Reference: Black Hills National Forest.

= Potr1/Syor1

Populus tremuloides/Symphoricarpos oreophilus/Carex geyeri h.t. (*POTR/SYOR/CAGE* h.t.)
(A)

Plant Association: Broadleaved, deciduous forest (averaging 167 ft^2/acre basal area) dominated exclusively by *Populus tremuloides*; *Symphoricarpos oreophilus* principal shrub; *Carex geyeri* dominant herbaceous species; species diversity and herbaceous cover high. A partial list of species with high constancy follows (% canopy coverage -- excluding trees -- in parentheses):

Tree Stratum -- *Populus tremuloides*.
Shrub Stratum -- *Amelanchier alnifolia* (2%), *Berberis repens* (4%), *Rosa woodsii* (1%), *Symphoricarpos oreophilus* (14%).
Herbaceous Stratum
Graminoids: *Agropyron trachycaulum* (1%), *Carex geyeri* (30%), *Elymus glaucus* (2%), and *Festuca thurberi* (1%).
Forbs: *Achillea lanulosa* (1%), *Erigeron speciosus* (1%), *Fragaria ovalis* (1%), *Helenium hoopesii* (t), *Smilicina stellata* (1%), *Thalictrum fendleri* (8%), and *Vicia americana* (34%).

Distribution: Widely distributed habitat type of the north-central Colorado Rocky Mountains; west of the continental divide; occurring primarily below the coniferous zone and immediately above the shrub-steppe.

8700 9680

Site Characteristics: Elevational Range -- 2,650m to 2,950m
Aspect Range -- southeast to west
Slope % Range -- 23% to 72%
Topographic Position -- intermediately mesic, moderate to steeply sloping hillsides; habitat type found on low slope positions of slight concave relief at lower elevations and variable slope positions of mostly concave surface relief at higher elevations.

Soil Characteristics: Moderately deep, fine loamy, slightly to only moderately gravelly and cobbly soils; solum, varying in depth from 45cm to over 100cm, comprised of a mollic epipedon and a cambic to argillic B horizon in most instances; coarse fragment content of solum ranges between 3% and 45%. The A-horizon pH varies from 6.5 to 7.4. Parent material of mostly granite, limestone, or sandstone origins.

Soil Families: clayey-skeletal mixed Argic Lithic Cryoboroll
clayey-skeletal mixed Lithic Cryochrept
fine loamy mixed Pachic and Argic Cryoboroll
loamy-skeletal mixed Pachic and Typic Cryoboroll
loamy-skeletal mixed Typic Cryoboralf

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Special Note: See *POTR/SYOR* h.t. (B) on following page.

L Potr1/Syor1

Populus tremuloides/Symphoricarpos oreophilus h.t. (*POTR/SYOR* h.t.)
(B)

Plant Association: Broadleaved tree forest dominated by *Populus tremuloides*; infrequent, non-reproducing conifers may be present; *Symphoricarpos oreophilus* primary shrub; high species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage -- excluding trees -- in parentheses):

Tree Stratum: *Populus tremuloides*.
Shrub Stratum: *Symphoricarpos oreophilus* (8%), *Berberis repens* (7%), and *Rosa woodsii* (3%).
Herbaceous Stratum
Graminoids: *Poa nervosa* (8%), *Agropyron griffithsii* (sic?), *Bromus marginatus* (6%), *Stipa richardsoni* (6%), *Festuca idahoensis* (5%), and *Carex hoodii* (5%).

Forbs: *Achillea millefolium* (17%), *Geranium richardsoni* (17%), *Lupinus argenteus parviflorus* (7%), *Taraxacum* spp. (2%), and *Agoseris glauca* (2%).

Distribution: Major habitat type on the western side of the Wind River Mountains; similar to other *Populus tremuloides* habitat types to the north and south except for different species of *Symphoricarpos* and other floristic dissimilarities, e.g., *Symphoricarpos utahensis* in Gothic Quadrangle, Colorado and *Symphoricarpos albus* in Montana.

7540 10170

Site Characteristics: Elevational Range -- 2,300m to 3,100m
Aspect Range -- variable
Slope % Range -- recorded but not published
Topographic Position -- mountainous upland terrain; more common at lower edge of coniferous forest; lower to middle elevations on variable slopes; landscape depressions, drainages, and low slope positions.

Soil Characteristics: Very deep (to 2m), slightly basic (pH 6.4 at surface) soils; A1 horizon, approximately 15cm deep, dark brown, silt loam; B2 horizon very clayey; C horizon very variable. Surface structure is granular to platy; subsoil structure is coarse angular blocky. Base saturation higher than all coniferous forest types except the *PSME/SYOR* h.t.

Soil Families: Information not available. Profile data provided.

Source Reference: R.M. Reed (1969; 1971).

Geographic Reference: Shoshone and Bridger National Forests.

Special Note: This habitat type is quite similar to the *POTR/SYOR/CAGE* h.t. of the White River National Forest except for the conspicuous absence of *Carex geyeri*. Therefore, the two habitat types can not be considered the same if the herbaceous canopy is included.

Populus tremuloides/Festuca thurberi h.t. (*POTR/FETH* h.t.)[1]

Plant Association: Mesic, high elevation deciduous forests characterized by a dominance of *Populus tremuloides* in the tree stratum and by *Festuca thurberi* in the herbaceous layer; and by moderate species diversity and rather high canopy coverage. A partial list of species with high constancy follows (% canopy cover for nontree species in parentheses):

Tree Stratum -- *Populus tremuloides*.
Shrub Stratum -- *Symphoricarpos oreophilus* (6%), *Rosa woodsii* (2%), and *Artemisia tridentata* (t).
Herbaceous Stratum
Graminoids: *Festuca thurberi* (34%), *Carex geyeri* (12%), *Stipa columbiana* (4%), and *Agropyron trachycaulum* (2%).
Forbs: *Achillea lanulosa* (2%), *Erigeron speciosus* (2%), *Geranium richardsonii* (1%), *Lathyrus leucanthus* (9%)*, and *Vicea americana* (3%)*.
*Note: Cover data here only for Arapaho-Roosevelt N.F.

Distribution: Minor habitat type which is found concentrated on both the eastern and western flanks of the Gore Range in the western Arapaho National Forest and northeastern White River National Forest.

Site Characteristics: Elevational Range -- 2,600m to 2,850m
Aspect Range -- southerly to westerly
Slope % Range -- 24% to 72%
Topographic Position -- within drainages or on concave surfaces suitable for snow accumulation but rather dry due to southerly exposures on moderately steep slopes.

Soil Characteristics: Soils have a distinct pachic mollic epipedon overlapping a moderately developed argillic B horizon and are relatively deep and loamy to sandy loam textured solums. Some subsurface soils are extremely cobbly and substrata also may be cobbly and derived from granite or sandstone. The pH of the A horizon ranges between 6.0 and 6.6. Coarse fragment content is variable and a shallow layer of decomposing leaves and twigs usually covers the ground surface.

Soil Families: loamy-skeletal mixed typic Cryoborolls;
loamy-skeletal mixed Pachic Cryoborolls;
fine-loamy mixed Pachic Cryoborolls.

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho-Roosevelt and White River National Forests.

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[1]Data are averages or encompass the variation found in both forests.

Populus tremuloides/Carex geyeri h.t. (*POTR/CAGE* h.t.)

Plant Association: Mesic, high elevation forests characterized by a dominance of *Populus tremuloides* in the tree layer and by *Carex geyeri* in the shrub stratum; and moderately high species diversity and high canopy coverage. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Populus tremuloides*.
Shrub Stratum -- *Berberis repens* (10%), *Juniperus communis* (3%), and *Rosa woodsii* (3%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (34%), *Bromus anomalus* (1%), and *Elymus glaucus* (1%).
Forbs: *Lathyrus leucanthus* (8%), *Achillea lanulosa* (1%), *Arnica cordifolia* (2%), and *Galium boreale* (1%).

Distribution: Major forested habitat type occurring extensively in the Arapaho-Roosevelt National Forest but more conspicuous in the northern Roosevelt National Forest.

Site Characteristics: 8040 9190
Elevational Range -- 2,450m to 2,800m
Aspect Range -- non-southerly; east to west
Slope % Range -- 15% to 60%
Topographic Position -- exposed terrain; those of lower elevation occur on low slope positions of slight concave relief; higher elevation sites are most commonly convex while distributed at a variety of slope positions.

Soil Characteristics: Fine to coarse textured, moderately deep (36-68 cm) solums consisting of pachic, mollic epipedons and cambic to argillic B horizons. Coarse fragment content varies greatly and is associated with degree of site inclination. The pH of the A horizon varies from 6.0 to 6.2. Alluvial and colluvial parent materials are of sedimentary, metamorphic, and igneous origins.

Soil Families: loamy-skeletal mixed Typic Cryoborolls on steep, convex phases;
fine-loamy mixed Argic Cryoborolls;
coarse-loamy mixed Argic Cryoborolls on intermediate slope and relief phases; and
coarse-loamy mixed Pachic Cryoborolls on moderate slopes and concave relief.

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forests.

Populus tremuloides/Heracleum lanatum h.t. (*POTR/HELA* h.t.)

Plant Association: Hypermesic, high elevation deciduous forests characterized by a dominance of *Populus tremuloides* in the tree stratum and by *Heracleum lanatum* in the herb layer; a closed tree canopy, rather high species diversity, and high canopy coverage of herbs, but a sparse shrub cover. A partial list of species with high constancy follows (% canopy coverage of nontree species in parentheses):

Tree Stratum -- *Populus tremuloides*.
Shrub Stratum -- *Sambucus racemosa* (3%) and *Symphoricarpos oreophilus* (1%).
Herbaceous Stratum
Graminoids: *Elymus glaucus* (7%), *Agropyron trachycaulum* (1%), *Bromus ciliatus* (1%), and *Poa pratensis* (t).
Forbs: *Heracleum lanatum* (58%), *Thalictrum fendleri* (10%), *Geranium richardsonii* (6%), *Senecio serra* (4%), *Cerastium arvense* (3%), *Hydrophyllum capitatum* (3%), *Galium boreale* (1%), *Lathyrus leucanthus* (t), and *Vicia americana* (t).

Distribution: Minor habitat type locally prominent on the southwestern side of the White River Plateau and in the far southwestern extension of the White River National Forest.

Site Characteristics: Elevational Range -- 2,550m to 2,900m (8360 to 9520)
Aspect Range -- variable
Slope & Range -- 6% to 22%
Topographic Position -- low positions of highly concave landscape relief with gentle slopes.

Soil Characteristics: Deep, well drained, and moderately permeable soils typically have a very thin layer of leaf litter covering a dark brown loam surface soil of about 24 cm thickness and a dark brown, silty clay loam subsoil as much as 75 cm in depth. Parent materials are alluvial deposits of shale and sandstone. The A horizon is neutral in reaction.

Soil Families: fine loamy mixed Argic Pachic Cryogorolls;
fine loamy mixed Pachic Cryoborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

= Potr1/Thfe1-Deba

Populus tremuloides/Thalictrum fendleri h.t. (*POTR/THFE* h.t.)

Plant Association: Hypermesic, high elevation forests dominated by *Populus tremuloides* in the tree stratum and by *Thalictrum fendleri* in the herbaceous layer; and having moderately high species diversity and canopy coverage. A partial list of species with high constancy follows (% canopy coverage for nontree species in parentheses):

Tree Stratum -- *Populus tremuloides*.
Shrub Stratum -- *Rosa woodsii* (2%) and *Juniperus communis* (1%).
Herbaceous Stratum
Graminoids: *Carex geyeri* (24%), *Agropyron trachycaulum* (1%), and *Bromus anomalus* (1%).
Forbs: *Ligusticum porteri* (34%), *Thalictrum fendleri* (25%), *Geranium richardsonii* (11%), *Lathyrus leucanthus* (8%), and *Taraxacum officinale* (1%).

Distribution: Minor forested habitat type found chiefly in the far northern Roosevelt National Forest and in the northwestern Arapaho National Forest.

Site Characteristics: 9020 9680
Elevational Range -- 2,750m to 2,950m
Aspect Range -- variable
Slope % Range -- 4% to 38%
Topographic Position -- low slope positions and concave relief conducive to a high water table and/or increased snow accumulation and moisture runoff retention.

Soil Characteristics: Principally mollisols derived from alluvial and colluvial material of sedimentary origin which are very deep (66-91 cm). Relatively fine textured solums comprised of a distinctly pachic mollic epipedon and a well developed argillic B horizon. Coarse fragment content relatively low; pH of the A horizon relatively high (6.4 to 7.0).

Soil Families: fine-loamy mixed Argic Pachic Cryoborolls; coarse-loamy mixed Argic Pachic Cryoborolls.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

What about Potr1/Thfe1/Cage1 from the White River NF? (Hess & Wasser 1982)!

< Alte-Betofall

Alnus tenuifolia/Equisetum arvense h.t. (*ALTE/EQAR* h.t.)

Plant Association: Tall shrub, riparian community dominated by *Alnus tenuifolia*, *Betula occidentalis*, and *Salix* spp. in the upper strata and by *Equisetum arvense* in the lower herbaceous strata; high species diversity and moderately high herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Tall Shrub: *Acer glabrum* (4%), *Alnus tenuifolia* (37%), *Betula occidentalis* (26%), and *Salix* spp. (45%).
- Medium Shrub: *Ribes inerme* (3%) and *Rosa woodsii* (3%).

Herbaceous Stratum
- Graminoids: *Calamagrostis canadensis* (14%), *Carex* spp. (10%), *Juncus balticus* (4%), and *Poa* spp. (2%).
- Forbs: *Campanula rotundifolia* (1%), *Cardamine cordifolia* (1%), *Equisetum arvense* (26%), *Heracleum lanatum* (3%), *Rudebeckia lacinata* (3%), *Smilicina stellata* (4%), and *Thalictrum fendleri* (2%).

Distribution: Widely distributed riparian habitat type; occurs in valley bottoms along small mountain streams; common throughout the northern Colorado Rocky Mountains on the eastern side of the continental divide.

6890 8530

Site Characteristics: Elevational Range -- 2,100m to 2,600m
Aspect Range -- variable
Slope % Range -- 0% to 10% (always gently sloping)
Topographic Position -- occupies flat, gently sloping stream banks which are normally inundated by spring runoff and which later maintain high ground water levels; rarely extends beyond 10m to 15m from stream edge.

Soil Characteristics: Moderately deep, coarse textured, very gravelly and cobbly soils; solum, frequently exceeding 40cm in depth, commonly comprised of a thick mollic epipedon and a cambic B horizon; subsurface mottling result of water saturation of the profile for much of the growing season; coarse fragment content of solum greater than 35%. The A-horizon pH varies between 6.0 and 6.2. Alluvial and fluvial deposits of mixed mineralogy provide the parent material.

Soil Families: loamy-skeletal mixed frigid Typic Haplaquoll

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

Artemisia arbuscula/Balsamorhiza sagittata h.t. (*ARBA/BASA* h.t.)

Plant Association: Xeric, low mountain elevation shrubland steppes characterized by dominance of *Artemisia arbuscula* in the shrub layer and *Balsamorhiza sagittata* in the herb stratum; weakly moderate diversity; and rather low canopy except for a weakly moderate shrub canopy. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Artemisia arbuscula* (20%), *Chrysothamnus depressus* (6%), *Symphoricarpos oreophilus* (2%), and *Amelanchier utahensis* (t).

Herbaceous Stratum

Graminoids: *Poa sandbergii* (3%), *Koeleria cristata* (2%), *Poa fendleriana* (1%), and *Sitanion hystrix* (1%).

Forbs: *Balsamorhiza sagittata* (9%), *Allium geyeri* (1%), *Agoseris glauca* (t), *Calochortus gunnisonii* (t), *Crepis occidentalis* (t), *Lomatium grayii* (1%), and *Senecio integerrimus* (t).

Distribution: Minor shrubland habitat type found chiefly in the far southwestern White River National Forest.

Site Characteristics: Elevational Range -- 2,300m to 2,500m
7540 8200
Aspect Range -- southerly and westerly
Slope % Range -- 2% to 23%
Topographic Position -- level to gently sloping, exposed and windswept upland benches and terraces.

Soil Characteristics: Deep, well drained but only slowly permeable soils typically having a brown clay surface layer about 2 cm thick overlying a brown clay subsurface layer about 98 cm thick. Dense clay subsoils create a barrier to root extension. The surface layer (A horizon) is mildly alkaline and very sticky and very plastic.

Soil Families: fine mixed (calcareous) frigid Vertic Ustorthents.

Source Reference: Hess and Wasser 1982).

Geographic Reference: White River National Forest.

Artemisia tripartita/Festuca idahoensis h.t. (*ARTRI/FEID* h.t.)

Plant Association: Physiognomically very low shrubland dominated by *Artemisia tripartita* in the shrub stratum and by *Festuca idahoensis* in the herbaceous layer; low species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Artemisia frigida* (1%), *Artemisia tripartita* (35%), and *Chrysothamnus viscidiflorus* (1%).

Herbaceous Stratum

Graminoids: *Agropyron spicatum* (2%), *Carex eleocharis* (1%), *Festuca idahoensis* (13%), *Hesperochloa kingii* (1%), *Koeleria cristata* (1%), *Poa fendleriana* (1%), *Poa sandbergii* (1%), and *Stipa comata* (1%).

Forbs: *Antennaria rosea* (1%), *Arenaria fendleri* (1%), *Eriogonum subalpinum* (1%), *Mertensia humilus* (t), *Phlox hoodii* (1%), and *Sedum stenopetalum* (t).

Distribution: Minor shrubland habitat type; locally abundant only in the far northeastern Colorado Rocky Mountains along the Laramie River watershed system; extends into southern Wyoming from the northern Red Feather District of the Roosevelt National Forest.

8200 8700

Site Characteristics: Elevational Range -- 2,500m to 2,650m
Aspect Range -- variable
Slope % Range -- 0% to 10%
Topographic Position -- rolling uplands of gentle inclinations and variable exposures; landscape relief variable, though generally not concave; exposed, windswept sites.

Soil Characteristics: Moderately deep, fine textured, variably gravelly and cobbly soils; solum, 30cm to 49cm deep, comprised of mollic epipedon with or without accompanying cambic or argillic B horizon; solum rests on hard, dense fragipan-like C horizon which occurs within 50cm of the soil surface; coarse fragment content of solum quite variable (10-50%). The A-horizon pH ranges from 6.2 to 7.6. Common parent material is of sedimentary origins.

Soil Families: loamy-skeletal mixed Typic Cryoboroll
loamy-skeletal mixed Argic Cryoboroll
coarse loamy mixed Typic Cryoboroll
coarse loamy mixed Argic Cryoboroll

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest (Red Feather District).

Artemisia cana/Festuca thurberi h.t. (*ARCA/FETH* h.t.)

Plant Association: Mesic, high elevation shrubland dominated by *Artemisia cana* in the shrub stratum and by *Festuca thurberi* in the herbaceous layer; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Artemisia cana* (30%) and *Potentilla fruticosa* (2%)
Herbaceous Stratum
Graminoids: *Agropyron trachycaulum* (t), *Bromus anomalus* (1%), *Bromus marginatus* (t), *Carex geyeri* (t), *Festuca thurberi* (30%), and *Stipa columbiana* (t).
Forbs: *Achillea lanulosa* (2%), *Aquilegia caerulea* (1%), *Erigeron speciosus* (3%), *Galium boreale* (1%), *Geranium richardsonii* (2%), *Potentilla gracilis* (1%), and *Vicia americana* (2%).

Distribution: Minor shrubland habitat type of the lower subalpine; common on very moist, frequently slightly saline sites; found principally west of the continental divide on high elevation lands of the northern Colorado Rocky Mountains.

Site Characteristics: 8860 9680
Elevational Range -- 2,700m to 2,950m
Aspect Range -- non-southerly
Slope % Range -- 0% to 15%
Topographic Position -- level to gently sloping, low-lying terrain or landscape depressions on upland sites; most prevalant on lands adjacent to Middle Park.

Soil Characteristics: Deep, fine textured, only slightly gravelly soils; solum, 65cm to 85cm deep, characterized by pachic mollic epipedon and well developed argillic B horizon; coarse fragment content of the solum generally less than 25%. The A-horizon pH ranges from 6.4 to 6.8. Most common parent material is derived from sedimentary origins.

Soil Families: fine loamy mixed Argic Pachic Cryoboroll
coarse loamy mixed Argic Pachic Cryoboroll
fine loamy mixed Argic Cryoboroll

Source Reference: Hess (1981).

Geographic Reference: Arapaho National Forest.

Artemisia tridentata/Festuca thurberi h.t. (*ARTR/FETH* h.t.)

Plant Association: Mesic, high elevation shrubland dominated by *Artemisia tridentata* in the shrub stratum and by *Festuca thurberi* in the herbaceous layer; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Artemisia tridentata* (32%) and *Symphoricarpos oreophilus* (3%).
- Low Shrub: *Rosa woodsii* (t).

Herbaceous Stratum
- Graminoids: *Agropyron trachycaulum* (1%), *Carex geyeri* (3%), *Festuca thurberi* (25%), *Koeleria cristata* (1%), and *Stipa* spp. (1%).
- Forbs: *Achillea lanulosa* (3%), *Agoseris glauca* (t), *Campanula rotundifolia* (t), *Erigeron speciosus* (1%), *Eriogonum* spp. (3%), and *Vicia americana* (2%).

Distribution: Major shrubland habitat type in the lower subalpine zone; common in coniferous and deciduous forest openings and more extensive non-forested uplands of the north-central Colorado Rocky Mountains; exclusively west of the continental divide.

Site Characteristics:
- Elevational Range -- 2,675m to 3,200m (8780 to 10500)
- Aspect Range -- variable; most commonly S.E. to S.W.
- Slope % Range -- 6% to 72%
- Topographic Position -- most commonly found on moderate to steeply sloping hillsides of mostly southerly exposures (landscape relief convex to flat); at lower elevations overlapping the distributional pattern of the *ARTR/FEID* h.t., the habitat type occupies more level terrain, commonly of flat to concave landscape relief, and more variable exposures.

Soil Characteristics: Deep, moderately textured, variably gravelly and cobbly soils; solum, varying from 40cm to 90cm in depth, comprised of well developed mollic epipedon (pachic or cumulic) and distinct cambic to argillic B horizon; coarse fragment content of solum is highly variable (5-50%). The A-horizon pH ranges from 6.6 to 7.6. Sandstone and limestone (less frequently shale or metamorphic rock) represent the most common parent materials.

Soil Families:
- loamy-skeletal mixed Typic Cryoboroll
- loamy-skeletal mixed Argic Cryoboroll
- loamy-skeletal mixed Cumulic Cryoboroll
- coarse loamy mixed Typic Cryoboroll
- coarse loamy mixed Pachic Cryoboroll

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

Artemisia tridentata/Festuca idahoensis h.t. (*ARTR/FEID* h.t.)

Plant Association: Mesic shrubland dominated by *Artemisia tridentata* in the shrub stratum and by *Festuca idahoensis* in the herbaceous layer; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Artemisia tridentata* (26%)
Herbaceous Stratum
Graminoids: *Carex heliophila* (1%), *Festuca idahoensis* (23%), *Koeleria cristata* (1%), *Poa sandbergii* (1%), and *Stipa lettermannii* (1%).
Forbs: *Antennaria rosea* (2%), *Calchortus gunnisonii* (t), *Castilleja* spp. (t), *Eriogonum* spp. (1%), *Potentilla* spp. (t), and *Vicia americana* (2%).

Distribution: Major shrubland habitat type; widely distributed in the upper montane and lower subalpine zones of the northcentral Colorado Rocky Mountains; prevalent on both sides of the continental divide.

7790 9790 ft

Site Characteristics: Elevational Range -- 2,375m to 2,985m
Aspect Range -- north aspects (lower elevations); south aspects (higher elevations).
Slope % Range -- 0% to 15%
Topographic Position -- gently sloping terraces and upland benches; flat to concave surface relief at lower elevations and mostly convex surface relief at higher elevations.

Soil Characteristics: Deep, loam to clay loam, variably gravelly and cobbly soils; solum, varying in depth from 35cm to 75cm, comprised of a mollic epipedon and a cambic to argillic B horizon; coarse fragment content of the solum is highly variable (5%-40%). The A-horizon pH ranges from 6.0 to 7.0. Mixed sedimentary and metamorphic rock are the most common parent material.

Soil Families: loamy-skeletal mixed frigid Entic Haploboroll
fine loamy mixed frigid Typic Argiboroll
loamy-skeletal mixed frigid Typic Argiboroll
coarse loamy mixed Argic Pachic Cryoboroll
fine mixed Argic Pachic Cryoboroll
loamy-skeletal mixed Pachic Cryoboroll
clayey-skeletal mixed Typic Cryoboroll
fine mixed Argic Cryoboroll

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

Artemisia tridentata/Elymus cinereus h.t. (*ARTR/ELCI* h.t.)

Plant Association: Mesic, physiognomically tall shrubland dominated by *Artemisia tridentata* in the shrub stratum and by *Elymus cinereus* in the herbaceous layer; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Artemisia tridentata* (33%), *Chrysothamnus nauseosus* (10%), *Chrysothamnus viscidiflorus* (5%), and *Symphoricarpos oreophilus* (7%).
- Low Shrub: *Rosa woodsii* (3%).

Herbaceous Stratum
- Graminoids: *Agropyron trachycaulum* (3%), *Elymus cinereus* (30%), and *Poa interior* (t).
- Forbs: *Achillea lanulosa* (2%), *Erigeron formosissimum* (2%), *Geranium fremontii* (1%), and *Vicia americana* (1%).

Distribution: A minor though locally abundant shrubland habitat type of river terraces and well-drained bottomlands; found exclusively west of the continental divide; reported in the north-central Colorado Rocky Mountains.

Site Characteristics: Elevational Range -- 2,350m to 2,675m
Aspect Range -- variable (most frequently southerly)
Slope % Range -- 5% to 20%
Topographic Position -- gently sloping river and stream terraces of variable exposures (lower elevations); gently to moderately inclined, upland swales and drainages of mostly southerly exposures.

Soil Characteristics: Very deep, loamy sand to sandy loam, only slightly gravelly soils; solum, frequently exceeding 100cm in depth, comprised of mollic epipedons and cambic B horizons; coarse fragment content of solum commonly less that 15%. The A-horizon pH ranges from 6.6 to 7.6. Alluvial and fluvial materials of mixed mineralogy represent the most common parent materials.

Soil Families: coarse loamy mixed frigid Cumulic Haploboroll
coarse loamy mixed frigid Fluventic Haplustoll
sandy mixed frigid Fluventic Haplustoll

Source Reference: Hess (1981).

Geographic Reference: Arapaho National Forest.

Artemisia tridentata/Elymus ambiguus h.t. (*ARTR/ELAM* h.t.)

Plant Association: Dry shrubland dominated by *Artemisia tridentata* in the shrub stratum and by *Elymus ambiguus* in the herbaceous layer; low species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Artemisia tridentata* (23%), *Purshia tridentata* (1%), *Ribes cereum* (1%), and *Rubus deliciosus* (1%).
- Low Shrub: *Artemisia frigida* (1%), *Leptodactylon pungens* (t), and *Opuntia polyacantha* (1%).

Herbaceous Stratum
- Graminoids: *Agropyron griffithsii* (1%), *Carex rossii* (2%), *Elymus ambiguus* (13%), and *Oryzopsis hymenoides* (1%).
- Forbs: *Artemisia ludoviciana* (t), *Cryptantha virgata* (t), *Eriogonum umbellatum* (t), *Potentilla fissa* (1%), and *Senecio fendleri* (t).

Distribution: A minor shrubland habitat type of very steep, rocky mountain slopes and canyon sides of the front range of the northern Colorado Rocky Mountains; most fully expressed on montane canyon walls bordering the Cache la Poudre River.

Site Characteristics: 7540 8530
Elevational Range -- 2,300m to 2,600m
Aspect Range -- southerly aspects
Slope % Range -- 60% to 75%
Topographic Position -- very steep, south facing mountain slopes and canyon faces; very rocky surfaces; variable landscape relief.

Soil Characteristics: Shallow, coarse textured, very gravelly and cobbly soils; Solum characterized by thin A horizon (10cm-18cm) overlying highly skeletal C horizon; coarse fragment content of solum exceeds 35%. The A-horizon pH is 6.8. Parent material is most commonly residual metamorphic rock.

Soil Families: sandy-skeletal mixed frigid Typic Ustorthent (most common)
loamy-skeletal mixed frigid Typic Argiboroll (one stand)

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Artemisia tridentata/Agropyron spicatum h.t. (*ARTR/AGSP* h.t.)

Plant Association: Physiognomically low, moderately open, semi-mesic shrubland dominated in the upper strata by *Artemisia tridentata* and in the lower herbaceous strata by *Agropyron spicatum*; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Artemisia tridentata* (28%).
- Low Shrub: *Artemisia frigida* (1%).

Herbaceous Stratum
- Graminoids: *Agropyron spicatum* (17%), *Carex heliophila* (1%), and *Koeleria cristata* (1%).
- Forbs: *Eriogonum subalpinum* (1%), *Penstemon secundiflorus* (t), and *Potentilla hippiana* (t).

Distribution: Widely distributed shrubland habitat type of the northern front range of the Colorado Rocky Mountains; locally abundant along the Laramie River and along mountain hillsides encompassing the northern boundary of Middle Park.

Site Characteristics: Elevational Range -- 2,500m to 2,650m (occassionally higher on very dry and exposed mountain slopes.
8200 8700
Aspect Range -- southerly exposures
Slope % Range -- 35% to 55%
Topographic Position -- moderate to steeply sloping hillsides of southerly aspects; low to mid slope positions on mostly flat to convex surface relief.

Soil Characteristics: Moderately shallow, coarse textured,very gravelly and cobbly soils; solum, not exceeding 40cm in depth, comprised of a minimally developed mollic epipedon and a thin cambic B horizon; coarse fragment content of solum ranges between 35% and 55%. The A-horizon pH varies from 6.6 to 7.0. Igneous, metamorphic, and sedimentary parent materials are commonly associated with this habitat type.

Soil Families: loamy-skeletal mixed frigid Typic Haploboroll
sandy-skeletal mixed frigid Typic Haploboroll

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forest.

Artemisia tridentata/Stipa comata h.t. (*ARTR/STCO* h.t.)

Plant Association: Physiognomically low, moderately open, semi-mesic shrubland dominated in the upper strata by *Artemisia tridentata* and in the lower herbaceous strata by *Stipa comata*; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Artemisia tridentata* (32%) and *Purshia tridentata* (9%).
- Low Shrub: *Artemisia frigida* (1%).

Herbaceous Stratum
- Graminoids: *Agropyron griffithsii* (1%), *Agropyron smithii* (2%), *Bouteloua gracilis* (3%), *Carex rossii* (1%), and *Stipa comata* (11%).
- Forbs: *Achillea lanulosa* (t), *Antennaria rosea* (t), *Mertensia lanceolata* (1%), and *Potentilla fissa* (t).

Distribution: Common shrubland habitat type in the far northern front range of the Colorado Rocky Mountains; occupies lowest elevation sites of all habitat types comprising the *Artemisia tridentata* series.

7710 8200

Site Characteristics:
- Elevational Range -- 2,350m to 2,500m
- Aspect Range -- mostly southerly
- Slope % Range -- 8% to 42%
- Topographic Position -- locally abundant on benches and moderate to steeply inclined low to mid slope positions of southerly aspects; landscape relief flat to convex.

Soil Characteristics: Moderately deep to deep, loam to sandy loam, variably gravelly and cobbly soils; solum, varying in depth from 55cm to over 70cm, comprised of well developed mollic epipedons and extensive argillic B horizons; coarse fragment content of solum is highly variable (10% to 45%). The A-horizon pH ranges from 6.2 to 6.6. Common parent materials include colluvial and alluvial materials of metamorphic and igneous origins.

Soil Families:
- fine loamy mixed frigid Typic Argiboroll
- loamy-skeletal mixed frigid Typic Argiboroll
- coarse-loamy mixed frigid Pachic Argiboroll

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Artemisia tridentata/Hesperochloa kingii h.t. (*ARTR/HEKI* h.t.)

Plant Association: Dry, physiognomically low shrubland dominated by *Artemisia tridentata* in the shrub stratum and by *Hesperochloa kingii* in the herbaceous layer; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows. (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Artemisia tridentata* (42%), and *Chrysothamnus viscidiflorus* (2%).
- Low Shrub: *Artemisia frigida* (t).

Herbaceous Stratum
- Graminoids: *Agropyron dasystachyum* (1%), *Carex heliophila* (t), *Festuca idahoensis* (8%), *Hesperochloa kingii* (20%), *Koeleria cristata* (1%), *Poa fendleriana* (4%), and *Poa sandbergii* (1%).
- Forbs: *Antennaria rosea* (t), *Astagalus miser* (1%), *Castilleja flava* (1%), *Delphinium geyeri* (1%), *Eriogonum subalpinum* (t), *Mertensia lanceolata* (t), *Penstemon alpinus* (1%), *Phlox longifolia* (2%), and *Vica americana* (1%).

Distribution: Minor habitat in the northern front range of the Colorado Rocky Mountains; locally abundant only on upland sites of the Laramie River drainage system; habitat type appears to extend into Wyoming.

8360 9100

Site Characteristics:
- Elevational Range -- 2,550m to 2,775m
- Aspect Range -- east, south, southwest
- Slope % Range -- 10% to 20%
- Topographic Position -- gentle to moderately sloping upland terrain of non-northerly aspects; relatively exposed, windswept sites.

Soil Characteristics: Moderately deep, coarse textured, only slightly gravelly and cobbly soils; solum, (60cm to 90cm deep), comprised of well developed mollic epipedon and distinct argillic B horizon; coarse fragment content of solum generally less than 15%. The A-horizon pH varies from 6.8 to 7.5. Sandstone and red siltstone are the most common parent material.

Soil Families:
- coarse loamy mixed frigid Pachic Argiboroll (lower elevations)
- coarse loamy mixed Argic Cryoboroll (higher elevations)
- coarse loamy mixed Argic Pachic Cryoboroll (higher elevations)

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest (Red Feather District).

L Droc/Care

Dryas octopetala/Arenaria obtusiloba h.t. (*DROC/AROB* h.t.)

Plant Association: Xeric to mesic, alpine mat-forming shrublands characterized by dominance of *Dryas octopetala* and *Arenaria obtusiloba* mats and cushions, respectively; by moderate species diversity and low canopy coverage particularly in the herb strata. A partial list of species of high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Dryas octopetala* (24%).
Herbaceous Stratum
Graminoids: *Carex rupestris* (5%), *Festuca brachyphylla* (1%), *Calamatrostic purpurascens* (1%), and *Poa rupicola* (1%).
Forbs: *Arenaria obtusiloba* (5%), *Trifolium dasyphyllum* (5%), *Arenaria fendleri* (1%), *Erigeron pinnatisectus* (1%), *Eritrichium elongatum* (1%), *Haplopappus pygmaeus* (1%), *Paronychia pulvinata* (1%), *Sedum stenopetalum* (1%), and *Silene acaulis* (1%).

Distribution: Minor alpine habitat type found near timberline on xeric to mesic, moderately sloping and variously exposed terrain; more abundant in the high mountains of the northern Roosevelt National Forest.

11320 11810

Site Characteristics: Elevational Range -- 3,450m to 3,600m
Aspect Range -- variable
Slope % Range -- 7% to 23%
Topographic Position -- exposed landscape near timberline occupying exposed, sloping or ridge sites.

Soil Characteristics: The more exposed, xeric sites are loamy-skeletal Entisols; coarse-loamy to loamy-skeletal Inceptisols characterize more mesic sites. Residual and colluvial parent materials usually are of granitic or gneissic origins. The solums of both soil types are relatively shallow and coarse textured. Coarse fragment contents of solums are variable. The pH of the A horizon varies from 5.6 to 6.4.

Soil Families: coarse-loamy mixed Pergelic Cryochrepts;
loamy-skeletal mixed Pergelic Cryochrepts;
loamy-skeletal mixed Pergelic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Dryas octopetala/Carex rupestris h.t. (*DROC/CARU* h.t.)

Plant Association: Semixeric, alpine dwarf-shrub communities characterized by dominance of *Dryas octopetala* in the low shrub stratum and by *Carex rupestris* in the herb layer; moderate level of species diversity; and a moderate canopy coverage of low shrubs, but a somewhat sparse cover of herbs. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Dryas octopetala* (42%) and *Salix arctica* (1%).
Herbaceous Stratum
Graminoids: *Carex rupestris* (9%), *Carex scopulorum* (2%), *Kobresia bellardii* (2%), *Festuca brachyphylla* (2%), and *Luzula spicata* (1%).
Forbs: *Geum rossii* (4%), *Potentilla diversifolia* (2%), *Artemisia scopulorum* (1%), *Lloydia serotina* (1%), *Smelowskia calycina* (1%), *Campanula rotundifolia* (t), *Gentiana algida* (t), *Haplopappus pygmaeus* (t), *Saxifraga chrysantha* (t), *Saxifraga rhomboidea* (t), and *Silene acaulis* (t).

Distribution: Minor alpine habitat type found in both the White River and Arapaho National Forests.

Site Characteristics: Elevational Range -- 3,650m to 3,825m
Aspect Range -- northerly
Slope % Range -- 42% to 59%
Topographic Position -- north facing, steep slopes exposed to prevailing northwest winter winds and receiving less persistent snow but good moisture infiltration due to gravel-covered surface and skeletal soil features.

Soil Characteristics: Moderately deep, well drained, and moderately permeable soils typically have a very dark brown, mucky silt loam surface layer about 10 cm thick and a very dark grayish brown, very gravelly loam subsurface layer about 10 cm over a very gravelly, sandy clay loam of igneous and metamorphic rock origin. Surface layer is slightly acid reacting.

Soil Families: loamy-skeletal mixed Pachic Cryoboroll.

Source Reference: Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

Purshia tridentata/Muhlenbergia montana h.t. (*PUTR/MUMO* h.t.)

Plant Association: Dry to moderately mesic, open, low-growing shrubland community dominated by *Purshia tridentata* in the upper strata and by *Muhlenbergia montana* in the lower herbaceous strata; moderate to high species diversity and moderate herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Purshia tridentata* (28%) and *Ribes cereum* (4%).
- Low Shrub: *Arctostaphylos uva-ursi* (2%) and *Artemisia frigida* (2%).

Herbaceous Stratum
- Graminoids: *Carex rossii* (1%), *Elymus ambiguus* (2%), *Hesperochloa kingii* (1%), *Muhlenbergia filiculmis* (2%), and *Muhlenbergia montana* (17%).
- Forbs: *Artemisia ludoviciana* (1%), *Chrysopsis villosa* (1%), *Cryptantha virgata* (t), *Eriogonum umbellatum* (2%), *Erysimum asperum* (t), *Phacelia heterophylla* (2%), and *Potentilla fissa* (2%).

Distribution: Very minor shrubland habitat type found at the upper elevational limits of the *Purshia tridentata* series; although present throughout the northern Colorado front range of the Rocky Mountains, the habitat type is most fully expressed within the Cache la Poudre watershed system.

Site Characteristics: Elevational Range -- 2,400m to 2,650m (7870 8700)
Aspect Range -- southeasterly to southwesterly
Slope % Range -- 45% to 60%
Topographic Position -- common on steep, exposed high montane hillsides of mostly southerly aspects; most predominant on upper slope positions of mostly convex landscape relief.

Soil Characteristics: Very shallow, coarse textured, gravelly and cobbly soils; solum consists of a very shallow (9cm-15cm), sandy loam A horizon overlying a highly skeletal C horizon; coarse fragment content of the solum exceeds 35%. The A-horizon pH ranges from 6.6 to 6.8. The most common parent material is comprised of colluvial and residual metamorphic rock.

Soil Families: loamy-skeletal mixed frigid Typic Ustorthent
sandy-skeletal mixed frigid Typic Ustorthent

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Purshia tridentata/Stipa comata h.t. (*PUTR/STCO* h.t.)

Plant Association: Dry to moderately mesic, open, low-growing shrubland community dominated by *Purshia tridentata* in the upper strata and by *Stipa comata* in the lower herbaceous strata; moderate species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Purshia tridentata* (29%) and *Rhus trilobata* (2%).
- Low Shrub: *Artemisia frigida* (4%) and *Opuntia polyacantha* (1%).

Herbaceous Stratum
- Graminoids: *Agropyron griffithsii* (1%), *Bouteloua gracilis* (4%), *Muhlenbergia montana* (1%), and *Stipa comata* (14%).
- Forbs: *Artemisia ludoviciana* (1%), *Chrysopsis villosa* (1%), *Eriogonum umbellatum* (1%), *Helianthus pumilus* (4%), *Phacelia heterophylla* (1%), and *Scutellaria brittonii* (1%).

Distribution: Minor shrubland habitat type occurring intermediate in elevation to habitat types of the *Cercocarpus montanus* series (below) and of the *Artemisia tridentata* series (above); common throughout the upper foothill and lower montane zone of the northern Colorado front range of the Rocky Mountains.

Site Characteristics: 5900 7710
Elevational Range -- 1,800m 2,350m
Aspect Range -- southerly exposures
Slope % Range -- 30% to 55%
Topographic Position -- occupies moderate to steeply sloping hillsides of mostly southerly aspects; mid to upper slope positions most common; landscape relief most frequently convex.

Soil Characteristics: Shallow to moderately shallow, coarse textured, very gravelly and cobbly soils; solum, generally not exceeding 35cm in depth, consists of an A horizon alone (Entisol) or a marginally developed mollic epipedon and a weakly expressed cambic B horizon; coarse fragment content of the solum ranges from 30% to over 70%. The A-horizon pH is between 6.4 and 7.2. Colluvium of schist and gneiss composition comprise the most common parent material.

Soil Families: loamy-skeletal mixed frigid Typic Haploboroll
sandy-skeletal mixed mesic Typic Ustorthent
sandy-skeletal mixed frigid Typic Ustorthent

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Cercocarpus montanus/Agropyron griffithsii h.t. (*CEMO/AGGR* h.t.)

Plant Association: Moderately mesic, dense shrubland community dominated in the upper strata by *Cercocarpus montanus* and in the lower herbaceous strata by *Agropyron griffithsii*; moderate to high species diversity and herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Cercocarpus montanus* (36%) and *Ribes cereum* (2%).
- Low Shrub: *Artemisia frigida* (1%) and *Opuntia polyacantha* (1%).

Herbaceous Stratum
- Graminoids: *Agropyron griffithsii* (19%), *Bouteloua gracilis* (1%), *Carex heliophila* (t), *Koeleria cristata* (1%), and *Stipa comata* (1%).
- Forbs: *Agoseris glauca* (t), *Cystopteris fragilis* (1%), *Eriogonum umbellatum* (3%), *Mertensia lanceolata* (1%), *Sedum stenopetalum* (t), and *Senecio integerrimus* (t).

Distribution: Minor shrubland habitat type, though locally abundant on north facing hillsides of the foothill zone; found exclusively along the northern Colordao front range of the Rocky Mountains.

5740 7220

Site Characteristics:
- Elevational Range -- 1,750m to 2,200m
- Aspect Range -- northerly exposures
- Slope % Range -- 30% to 60%
- Topographic Position -- occupies a narrow and often discontinuous landscape belt bordered by habitat types of the *Pseudotsuga menziesii* series on steeper terrain and of the *Stipa comata* series on gentler, more level terrain; landscape relief primarily convex, particularily on more steeply inclined terrain.

Soil Characteristics: Moderately shallow to moderately deep, loam to sandy loam, variably gravelly and cobbly soils; solum, varying in depth from 16cm to 45cm, consists of either an A horizon alone (Entisol) or a mollic epipedon and a cambic to argillic B horizon; coarse fragment content of the solum is variable, though commonly exceeding 25%. The A-horizon pH varies from 6.9 to 7.4. Colluvial deposits of granite, schist, and gneiss comprise the most common parent material.

Soil Families:
- coarse-loamy mixed frigid Entic Haplustoll
- loamy-skeletal frigid Typic Haploboroll
- loamy-skeletal mixed frigid Typic Argiboroll
- sandy mixed frigid Typic Ustorthent

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Cercocarpus montanus/Stipa comata h.t. (*CEMO/STCO* h.t.)

Plant Association: Dry, open shrubland community dominated in the upper strata by *Cercocarpus montanus* and in the lower herbaceous strata by *Stipa comata*; moderate species diversity and low to moderate herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum
- Medium Shrub: *Cercocarpus montanus* (29%) and *Rhus trilobata* (t).
- Low Shrub: *Artemisia frigida* (3%) and *Opuntia polyacantha* (2%).

Herbaceous Stratum
- Graminoids: *Agropyron griffithsii* (1%), *Bouteloua gracilis* (2%), and *Stipa comata* (13%).
- Forbs: *Allium textile* (t), *Artemisia ludoviciana* (t), *Astragalus parryi* (t), *Eriogonum umbellatum* (t), *Helianthus pumilus* (4%), *Lesquerella montana* (t), and *Scutellaria brittonii* (t).

Distribution: Major shrubland habitat type of the foothill zone; common on low elevation hillsides and canyon walls of the northern Colorado front range of the Rocky Mountains.

Site Characteristics: Elevational Range -- 1,750m to 2,050m (5740 6730)
Aspect Range -- mostly southerly exposures
Slope % Range -- 25% to 60%
Topographic Position -- found on moderate to steeply sloping terrain of mostly southerly exposure; landscape relief generally convex; slope position variable.

Soil Characteristics: Shallow, coarse textured, gravelly and cobbly soils; solum, consisting only of a shallow A horizon (4cm-12cm), overlies an extremely skeletal C horizon; coarse fragment content of the solum generally exceeds 30%. The A-horizon pH varies from 6.4 to 6.8. Parent material comprised of igneous and metamorphic residuum and colluvium.

Soil Families: sandy-skeletal mixed mesic Typic Ustorthent

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

= Sage-SALI/CACA

Salix geyeriana/Calamagrostic canadensis h.t. (*SAGE/CACA* h.t.)

Plant Association: Hydric, montane-zone shrubland characterized by dominance of *Salix geyeriana* in the shrub stratum and by *Calamagrostic canadensis* in the herb layer; a moderately open tall shrub canopy, moderate species diversity, and rather high canopy coverage of herbs particularly of graminoids. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Salix geyeriana* (27%) and *Salix monticola* (23%).
Herbaceous Stratum
Graminoids: *Calamagrostic canadensis* (43%), *Carex aquatilis* (6%), *Phleum pratense* (4%), *Carex festivella* (3%), and *Carex rostrata* (3%).
Forbs: *Fragaria ovalis* (4%), *Taraxacum officinale* (4%), *Castilleja septentrionalis* (4%), *Erigeron peregrinus* (3%), and *Polemonium occidentalis* (3%).

Distribution: Minor shrubland habitat type of montane zone, common on moist low lying sites; found principally in northern and central Colorado in mountain valleys and streamsides of rather low gradient, in which the streams often are aggrading.

8600 9000

Site Characteristics: Elevational Range -- 2,620m to 2,730m
Aspect Range -- none to north
Slope % Range -- 0 to 5%
Topographic Position -- level to gently sloping, low lying sites chiefly in mountain valleys and streamsides.

Soil Characteristics: moderately deep to deep, fine to medium textured solums up to 80 cm deep, with dark brown, silty, crumb-structured A horizons grading into mottled yellowish brown, silty loam to silty clay loams of fine to very fine subangular structure in the B horizon. Some clay skins evident in latter. Coarse fragment content generally nil; the pH of the A horizon 6.0 to 6.8. Parent material of sedimentary origin.

Soil Families: fine-loamy mixed Argic Cryaquolls.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

= SALI/Gero1

Salix arctica/Geum rossii h.t. (*SAAR/GERO* h.t.)

Plant Association: Mesic, very high elevation, low shrublands characterized by dominance of *Salix arctica* in the low shrub stratum and by *Geum rossii* in the herb layer; relative high species diversity and moderate canopy coverage of shrubs and forbs but sparse cover of graminoids. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Salix arctica* (26%).
Herbaceous Stratum
Graminoids: *Carex chalciolepis* (1%), *Festuca brachyphylla* (1%), and *Trisetum specatum* (1%).
Forbs: *Artemisia scopulorum* (8%), *Erigeron simplex* (2%), *Geum rossii* (8%), *Polygonum bistortoides* (1%), *Polgonum viviparum* (1%), *Potentilla diversifolia* (1%), *Saxifraga rhomboidea* (1%), and *Trollius laxa* (1%).

Distribution: Minor alpine habitat type found in both the White River and southwestern Arapaho National Forests.

Site Characteristics: Elevational Range -- 3,600m to 3,775m (11810 to 12390)
Aspect Range -- northerly to easterly
Slope % Range -- 8% to 26%
Topographic Position -- mid to upper slope positions with convex surface relief.

Soil Characteristics: Moderately deep, well drained, and rapidly permeable soils typically having a brown loam surface layer about 5 cm thick and a brown, very gravelly loam subsoil about 15 cm thick overlying a yellowish brown, extremely gravelly, sandy loam substratum of mostly igneous origin. Surface layer is strongly acid.

Soil Families: loamy-skeletal mixed Typic Cryochrepts.

Source Reference: Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

Salix planifolia/Deschampsia caespitosa h.t. (*SAPL/DECA* h.t.)

Plant Association: Semihydric, high elevation shrublands dominated by *Salix planifolia* in the shrub stratum and by *Deschampsia caespitosa* in the herb layer; and further characterized by having a moderately open shrub canopy, relatively high species diversity, and moderately high herbaceous canopy cover. A partial list of species of high constancy follows: (% canopy cover in parentheses):

Shrub Stratum -- *Salix planifolia* (41%).
Herbaceous Stratum
Graminoids: *Deschampsia caespitosa* (41%), *Carex aquatilis* (4%), *Carex microptera* (1%), *Eleocharis pauciflorus* (1%), and *Phleum pratense* (1%).
Forbs: *Caltha leptosepala* (19%), *Erigeron peregrinus* (2%), *Pedicularis groenlandica* (2%), *Sedum rhodanthum* (2%), and *Veronica wormsjoldii* (1%).

Distribution: Minor shrubland of the subalpine found in the Front Range and along the Continental Divide and interior valleys of the Arapaho and Roosevelt National Forests.

Site Characteristics: Elevation Range -- 2,850m to 3,400m
Aspect Range -- easterly to southwesterly
Slope % Range -- 2% to 7%
Topographic Position -- level to gently sloping forest openings and valley bottoms, poorly drained but better drained than the *SAPL/CAAQ* h.t.

Soil Characteristics: Shallow to medium depth, fine textured soils; solums 17 to 44 cm deep characterized by a high organic matter contnet, umbric epipedon and a cambic B horizon which occasionally may be absent. Coarse fragments generally are nonexistent but may uncommonly comprise 35%. The pH of the A horizon ranges from 5.2 to 6.0. Soils are predominantly mineral and are derived from alluvial and colluvial parent materials.

Soil Families: loamy-skeletal mixed Aquic Cryumbrepts and coarse-loamy mixed Aquic Cryumbrepts.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt and Arapaho National Forests.

Salix planifolia/Carex aquatilis h.t. (*SAPL/CAAQ* h.t.)

Plant Association: Hydric, high elevation shrublands dominated by *Salix planifolia* in the shrub stratum and *Carex aquatilis* in the herbaceous layer; high species diversity and rather high canopy coverage. A partial list of species of high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Salix planifolia* (52%) and *Betula glandulosa* (10%).
Herbaceous Stratum
Graminoids: *Carex aquatilis* (53%), *Carex rupestris* (14%), *Calamatrostic canadaensis* (2%), and *Deschampsia caespitosa* (2%).
Forbs: *Caltha leptosepala* (4%), *Sedum rhodanthum* (3%), *Pedicularis groenlandica* (1%), and *Erigeron peregrinus* (1%).

Distribution: Important and widely distributed shrubland habitat type of montane and subalpine elevations. Found from middle to near alpine elevations both sides of the Continental Divide in the Arapaho and Roosevelt National Forests.

Site Characteristics: Elevational Range -- 2,725m to 3,300m
Aspect Range -- variable
Slope % Range -- 2% to 6%
Topographic Position -- low terrain of valley bottoms, basins, landscape depressions in forest openings, narrow floodplains of mountain streams, and all areas of drainage accumulation and high seepage.

Soil Characteristics: Very deep peaty muck to muck peat organic soils; solum 80 to over 100 cm deep; high ground water levels. A horizon has a pH of 5.0 to 6.6 and is moist to saturated at all times.

Soil Families: Histosols represented by Typic Cryohemists on poorly drained sites and Typic Cryosaprists on areas of improved drainage.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

Salix planifolia/Carex scopulorum h.t. (*SAPL/CASC* h.t.)

Plant Association: Semi-hydric, alpine shrublands dominated by *Salix planifolia* in the shrub stratum and by *Carex scopulorum* in the herbaceous layer; and characterized by a moderately high species diversity and moderately high canopy coverage of both the shrub and herb strata. A partial list of species with high species constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Salix planifolia* (62%).
Herbaceous Stratum
Graminoids: *Carex scopulorum* (37%) and *Eleocharis pauciflora* (1%).
Forbs: *Geum rossii* (5%), *Caltha leptosepala* (4%), *Pedicularis groenlandica* (1%), *Polygonum bistordes* (1%), *Sedum rhodanthum* (1%), *Sedum rosea* (1%), *Trifolium parryi* (1%).

Distribution: Major habitat type in the low and middle alpine region; common in areas irrigated by persistent but melting snowfields; common in moister alpine regions adjacent to the Continental Divide and Front Range cordillera in both the Arapaho and Roosevelt National Forests.

Site Characteristics: 11480 12390
Elevational Range -- 3,500m to 3,775m
Aspect Range -- variable
Slope % Range -- 4% to 17%
Topographic Position - gently to moderately sloping terrain of alpine basins and slopes which are below persistent, melting snowfields.

Soil Characteristics: Shallow to moderately deep, high organic matter, loamy mineral or organic soils. Former are derived from alluvial and colluvial parent materials of mixed origin. Both are underlain by coarse textured C horizons. Coarse fragment content of solums are highly variable. The pH of surface soil layers vary between 4.8 and 5.4. Considerable soil frost activity is evidenced by soil-surface irregularities.

Soil Families: organic soils are Pergelic Cryosaprists; mineral soils are coarse-loamy mixed Pergelic Cryaquepts; and loamy-skeletal mixed Pergelic Cryaquepts.

Source Reference: Hess (1981).

Geographic Reference: Arapaho and Roosevelt National Forests.

What about Sapl/Casc2 from the White River NF?? (Hess & Wasser 1982)!!

Salix planifolia/Caltha leptosepala h.t. (*SAPL/CALE* h.t.)

Plant Association: Hydric, high elevation shrublands typically dominated by *Salix planifolia* in the shrub stratum and by *Caltha leptosepala* in the herb layer; also characterized by a moderately closed shrub canopy, a high species diversity, and high canopy coverage. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Salix planifolia* (61%) and *Salix brachycarpa* (12%).
Herbaceous Stratum
Graminoids: *Deschampsia caespitosa* (4%) and *Poa reflexa* (t).
Forbs: *Caltha leptosepala* (20%), *Ligusticum porteri* (3%), *Delphinium barbeyi* (2%), *Achillea lanulosa* (1%), *Pseudocymopteris montanus* (1%), and *Veronica wormsjoldii* (t).

Distribution: Major habitat type in wetland environments throughout the White River and southwestern Arapaho National Forests.

Site Characteristics: Elevational Range -- 2,875m to 3,300m
9430 10830
Aspect Range -- non-northerly
Slope % Range -- 2% to 8%
Topographic Position -- along drainages, in low valley bottoms, on landscape depressions and seepage areas and on other hydric areas.

Soil Characteristics: Soils mostly mineral in composition, poorly drained and slowly permeable. Surface layer dark brown loam about 20 cm thick covered by a thin layer of decaying plant debris. Subsoil a reddish brown clay loam about 71 cm thick over soft decaying sandstone or other sedimentary rocks. Surface layer slightly acid to slightly alkaline (pH 6.2 - 7.4).

Soil Families: fine-loamy mixed and coarse-loamy mixed Argic Pachic Cryoborolls; fine-loamy and fine-loamy mixed Argic Cryoborolls; clayey mixed euic Terric Cryohemists; and euic Typic Cryosaproists.

Source Reference: Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

∠Sa81-Sabr1/Deca

Salix pseudolapponum/Deschampsia caespitosa h.t. (*SAPS/DECA* h.t.)
(A)

Plant Association: Mesic, low alpine shrublands characterized by dominance of *Salix pseudolapponum* in the shrub layer and *Deschampsia caespitosa* in the herb layer; by a moderate shrub canopy cover, relatively high species diversity and canopy coverage of the understory. A partial list of species of high constancy follows (% canopy in parentheses):

Shrub Stratum -- *Salix pseudolapponum* (47%) and *Salix planifolia* (t).
Herbaceous Stratum
Graminoids: *Deschampsia caespitosa* (29%), *Festuca brachyphylla* (1%), *Trisetum spicatum* (1%), and *Carex chalciolepis* (1%).
Forbs: *Trifolium parryi* (13%), *Geum rossii* (9%), *Artemisia scopulorum* (7%), *Polygonum bistortoides* (2%), *Castilleja occidentalis* (1%), and *Mertensia viridis* (1%).

Distribution: Minor but important habitat type of the lower alpine, particularly near the Continental Divide in the Roosevelt National Forest.

11480 11900

Site Characteristics: Elevational Range - 3,500m to 3,625m
Aspect Range -- non-southerly
Slope % Range -- 20% to 45%
Topographic Position -- low slope positions of exposed terrain with moderate levels of snow accumulation

Soil Characteristics: Moderately deep, coarse textured Inceptisol soils with dark, well developed umbric epipedons and cambic B horizons derived from alluvial/colluvial granites, gneisses, and schists. The pH of the A horizon varies from 5.1 to 5.8. Coarse fragment content mostly less than 25% in the A horizon but up to 55% in the B horizon.

Soil Families: loamy-skeletal mixed Typic Cryumbrepts; coarse-loamy mixed Typic Cryumbrepts.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Special Note: See *SAPS/DECA/GERO*(B) on following page. These two are reasonably similar except for variations in the soil family units, third (forb) dominants, and probably could be merged into one h.t. with phases.

∠Sagl-Sobr1/Deca

Salix pseudolapponum/Deschampsia caespitosa/Geum rossii h.t.
(*SAPS/DECA/GERO* h.t.)
(B)

Plant Association: Mesic, low alpine shrubland dominated by *Salix pseudolapponum* in the shrub stratum, by *Deschampsia caespitosa* in the herb with *Geum rossii* a conspicuous secondary associate; moderately high canopy cover of shrubs, weakly moderate cover of herbs except for graminoids but relatively high species diversity. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Salix pseudolapponum* (53%), *Salix planifolia* (11%), and *Salix brachycarpa* (3%).
Herbaceous Stratum
Graminoids: *Deschampsia caespitosa* (6%).
Forbs: *Geum rossii* (6%), *Artemisia scopulorum* (4%), *Trifolium parryi* (3%), *Potentilla diversifolia* (2%), *Erigeron simplex* (1%), *Saxifraga rhomboidea* (1%), and *Trollius laxus* (1%).

Distribution: Common habitat type on upland sites of the lower alpine zone throughout the White River and southwestern Arapaho National Forests.

11480 '12220

Site Characteristics: Elevational Range -- 3,500m to 3,725m
Aspect Range -- variable
Slope % Range - 4% to 34%
Topographic Position -- on upland mesic sites with mineral soils, on relatively protected, gentle to moderately sloping terrain, along all slope positions and landscape relief where moderate levels of winter snows accumulate or some subsurface seepage occurs during the later growing season.

Soil Characteristics: The moderately deep, somewhat poorly drained, and rapidly permeable solums typically have a very dark, grayish brown, and very gravelly surface layer about 5 cm thick; a very dark grayish brown, very gravelly loam subsoil about 31 cm thick situated over a pale brown, extremely cobbly sandy loam substratum of mostly granite and schist origins. The pH varies between 5.0 and 5.4 and the coarse fragment content is low to medium, usually less than 35%.

Soil Families: loamy-skeletal mixed Typic Cryoborolls.

Soil Reference: Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

= Agsp/Posa1

Chrysothamnus viscidiflorus/Agropyron spicatum h.t. (*CHVI/AGSP* h.t.)

Plant Association: Xeric, upper montane shrub-steppe typified by dominance of *Chrysothamnus viscidiflorus* in the low-shrub layer and *Agropyron spicatum* in the herb layer; by an open shrub canopy, weakly moderate species diversity, and sparse canopy coverage. A partial list of species of high constancy follows (% canopy cover in parentheses):

Shrub Stratum -- *Chrysothamnus viscidiflorus* (12%), *Artemisia frigida* (4%), and *Tetradymia canescens* (1%).

Herbaceous Stratum

Graminoids: *Agropyron spicatum* (8%), *Koeleria cristata* (3%), *Carex heliophila* (2%), *Stipa comata* (2%), and *Poa sandbergii* (2%).

Forbs: *Sedum stenopetalum* (2%), and *Castilleja linariaefolia* (t).

Distribution: Minor though conspicuous habitat type found on windy, exposed south-facing slopes in the northern Roosevelt National Forest.

8200 8860

Site Characteristics: Elevational Range -- 2,500m to 2,700m
Aspect Range -- southerly
Slope % Range -- 10% to 20%
Topographic Position -- windswept knolls and exposed, moderately inclined upper slopes of south facing aspects.

Soil Characteristics: Shallow Entisols with rocky A and C horizons which meet fractured bedrock of granite at about 30cm depths. The pH of the A horizon is 6.8 to 7.4. The surface layer is sandy loam to loamy sand. Coarse fragment content is variable, up to 45%. The ground has about 40% of the surface showing bare soil and exposed rock.

Soil Families: Coarse-loamy mixed Lithic Cryorthents.

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Juncus balticus/Carex spp. h.t. (*JUBA/CAREX* h.t.)

Plant Association: Wet grassland dominated by a mixture of grass and grass-like species; *Juncus balticus* principal herbaceous component; *Carex* spp. abundant; species diversity low. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Potentilla fruticosa* (2%).
Herbaceous Stratum
Graminoids: *Calamagrostis canadensis* (t), *Carex festivella* (2%), *Carex lanuginosa* (1%), *Carex nebraskensis* (9%), *Deschampsia caespitosa* (5%), *Eleocharis rostellata* (t), *Hierochloe odorata* (1%), *Juncus balticus* (56%), *Phleum pratense* (2%), and *Poa pratensis* (6%).
Forbs: *Achillea lanulosa* (2%), *Caltha leptosepala* (2%), *Dodecatheon pulchellum* (t), *Ranunculus pedatifidus* (1%), and *Taraxacum officinale* (2%).

Distribution: A minor wetland habitat type specific to poorly drained, low-lying terrain at lower elevations of the northern Colorado front range of the Rocky Mountains.

6560 8200

Site Characteristics: Elevational Range -- 2,000m to 2,500m
Aspect Range -- variable
Slope % Range -- 0% to 4%
Topographic Position -- level to nearly level bottomlands exhibiting poor drainage; other upland sites of concave surface relief and high moisture retention.

Soil Characteristics: Moderately deep organic soils; organic horizons are peaty muck in texture and extend in depth to over 50cm to a loose, incoherent gravelly substratum. The pH of the organic horizons vary between 5.6 and 6.2.

Soil Families: Typic Borosaprist (subgroup only)

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Carex rupestris/Trifolium dasyphyllum h.t. (*CARU/TRDA* h.t.)

Plant Association: Dry alpine grassland dominated by a mixture of grass-like plants and forbs; principally among these are *Carex rupestris*, *Geum rossii*, and *Trifolium dasyphyllum*; moderate species diversity and moderate canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Agropyron scribneri* (1%), *Calamagrostis purpurascens* (2%), *Carex elynoides* (1%), *Carex rupestris* (29%), *Danthonia intermedia* (1%), *Festuca ovina brachyphylla* (1%), *Poa rupicola* (1%), and *Trisetum spicatum* (t).

Forbs: *Arenaria fendleri* (2%), *Arenaria obtusiloba* (3%), *Artemisia scopulorum* (3%), *Geum rossii* (9%), *Haplopappus pygmaeus* (1%), *Oreoxis alpina* (1%), *Sedum stenopetalum* (1%), and *Trifolium dasyphyllum* (15%).

Distribution: A minor though locally abundant habitat type of the low to intermediate alpine; relatively exposed, snow-free sites; commonly found only in the alpine zone of the northern Colorado front range of the Rocky Mountains.

Site Characteristics: Elevational Range -- 3,500m to 3,800m (11480 12470)
Aspect Range -- variable
Slope % Range -- 5% to 40%
Topographic Position -- gently inclined saddles and moderately inclined mid to upper slope positions; environment less xeric than *TRNA/PAPU* h.t. as result of less exposure to prevailing winds; landscape relief flat to convex.

Soil Characteristics: Moderately shallow, silty loam to sandy loam, gravelly and cobbly soils; solum, only 10cm to 15cm deep, consists only of a gravelly A horizon overlying a coarse textured, skeletal C horizon; coarse fragment content of the solum is highly variable (15% to 40%). The A-horizon pH varies between 5.8 and 6.2. Common parent materials include colluvial materials of granite and gneiss composition.

Soil Families: loamy-skeletal mixed Typic Cryorthent

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forest.

= Caru/Miob ph. Gero1

Carex rupestris/Geum rossii h.t. (*CARU/GERO* h.t.)

Plant Association: Dry alpine grassland dominated by a mixture of grass-like plants and forbs; principally among these are *Carex rupestris*, and *Geum rossii*; moderate species diversity and moderate canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Calamagrostis purpurascens* (2%), *Carex rupestris* (20%), *Carex scopulorum* (t), *Luzula spicata* (t), *Poa rupicola* (1%), and *Trisetum spicatum* (t).

Forbs: *Arenaria obtusiloba* (1%), *Artemisia scopulorum* (2%), *Campanula rotundifolia* (1%), *Geum rossii* (14%), *Haplopappus pygmaeus* (3%), *Hymenoxys grandiflora* (1%), *Oreoxis alpina* (4%), *Saxifraga rhomboidea* (1%), *Sedum stenopetalum* (1%), *Silene acaulis* (1%) and *Trifolium nanum* (2%).

Distribution: A minor though locally abundant habitat type of the low to intermediate alpine; relatively exposed, snow-free sites; commonly found only in the alpine zone of the north-central Colorado Rocky Mountains, west of the continental divide.

Site Characteristics: Elevational Range -- 3,600m to 4,000m (11810 13130)
Aspect Range -- mostly non-northerly exposures
Slope % Range -- 10% to 30%
Topographic Position -- less xeric sites than *CARU/TRDA* h.t.; moderately sloping saddles and mid to upper slope positions of flat to convex landscape relief; moderate exposure to prevailing winds maintains mostly snow-free surface.

Soil Characteristics: moderately shallow, loam to sandy loam, gravelly and cobbly soils; solum, 25cm to 35cm in depth, comprised of mollic epipedon and, infrequently, a cambic B horizon; coarse fragment content of solum exceeds 35%. The A-horizon pH varies between 5.2 and 6.1. Parent material of mostly granite and schist composition.

Soil Families: loamy-skeletal mixed Typic Cryoboroll

Source Reference: Hess (1981).

Geographic Reference: White River-Arapaho National Forest.

= Cosc2/Seri2-Secn

Carex scopulorum/Caltha leptosepala h.t. (*CASC/CALE* h.t.)

Plant Association: Hydric alpine grassland dominated by a mixture of grass-like plants and forbs; principally among these are *Carex scopulorum* and *Caltha leptosepala*; low species diversity and moderate to high herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Salix planifolia* (2%).
Herbaceous Stratum
Graminoids: *Carex scopulorum* (46%) and *Deschampsia caespitosa* (5%).
Forbs: *Caltha leptosepala* (17%), *Castilleja occidentalis* (1%), *Geum rossii* (1%), *Pedicularis groenlandica* (1%), *Polygonum bistortoides* (1%),and *Sedum rhodanthum* (2%).

Distribution: Major bogland habitat type of the low to mid alpine; most frequently found in poorly drained areas throughout the alpine zone of the north-central Rocky Mountains; equally distributed on both sides of the continental divide.

11150 12470

Site Characteristics: Elevational Range -- 3,400m to 3,800m
Aspect Range -- variable
Slope % Range -- 0% to 6%
Topographic Position -- occupies level to near level alpine terrain of bottom areas and landscape depressions where high levels of moisture collect as the result of snowfall or snow-melt accumulation; cold air drainage combined with moist soil conditions often results in permafrost.

Soil Characteristics: Deep to moderately deep high organic content mineral soils (east of the continental divide) and organic soils (west of the continental divide); organic soils extend 40m to 50cm in depth over very gravelly substratum; mineral soils exhibit organic rich A horizons and distinctly mottled cambic B horizons; coarse fragment content of the solum varies from 0% in the peat soils to over 35% in the organic rich mineral soils. The surface pH varies from 4.8 to 5.4. Organic matter and colluvial granite, schist, and gneiss comprise the most common parent material.

Soil Families: coarse loamy mixed Humic Pergelic Cryaquept
sandy-skeletal mixed Humic Pergelic Cryaquept
coarse-loamy and sandy-skeletal mixed Pergelic Cryaquept
sandy-skeletal mixed euic Terric Cryosaprist
euic Pergelic Cryosaprist

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

=Caaq/Caro2

Carex rostrata/Carex aquatilis h.t. (*CARO/CAAQ* h.t.)

Plant Association: Hydric grassland dominated by a mixture of grasslike species; principally among these are *Carex rostrata* and *Carex aquatilis*; very low species diversity and canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Carex aquatilis* (39%), *Carex canescens* (1%), *Carex rostrata* (36%), *Deschampsia caespitosa* (1%), and *Eleocharis* spp. (t).

Forbs: *Caltha leptosepala* (5%), *Epilobium* spp. (t), *Galium* spp. (t), *Pedicularis groenlandica* (1%), *Sedum rhodanthum* (t), and *Veronica wormskjoldii* (t).

Distribution: A common and widely distributed hydric grassland of valley bottoms and poorly drained uplands; found within the spruce-fir zone of the north-central Colorado Rocky Mountains on both sides of the continental divide.

Site Characteristics: Elevational Range -- 2,750m (9020) to 3,350m (10990)
Aspect Range -- variable
Slope % Range -- 0% to 5%
Topographic Position -- level to nearly level terrain of flat to concave landscape relief which, because of topographic position and subsequent inundation following snow melt, are poorly drained and subject to high ground water levels throughout the growing season.

Soil Characteristics: Deep organic soils, saturated with water for much of the growing season; soil texture varies from peaty muck to muck; depth to mineral substratum exceeds 1m in most instances; ground water level in late summer 30cm to 60cm below the surface. The pH at 10cm ranges from 5.6 to 7.0. Decaying plant debris provide soil parent material.

Soil Families: Typic Cryosaprist (subgroup only)
Typic Cryohemist (subgroup only)
fine mixed Argic Cryaquoll
euic Typic Cryosaprist

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

Carex elynoides/Geum rossii h.t. (*CAEL/GERO* h.t.)

Plant Association: Dry alpine grassland dominated by a mixture of grass-like plants and forbs; principally among these are *Carex elynoides*, *Geum rossii*, and *Trifolium dasyphyllum*; moderate species diversity and moderate canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Agropyron scribneri* (t), *Carex elynoides* (54%), *Carex rupestris* (3%), *Festuca ovina brachyphylla* (t), *Poa rupicola* (1%), and *Trisetum spicatum* (t).

Forbs: *Arenaria fendleri* (2%), *Arenaria obtusiloba* (1%), *Campanula rotundifolia* (t), *Castilleja occidentalis* (t), *Geum rossii* (16%), *Mertensia viridis* (1%), *Potentilla diversifolia* (2%), and *Trifolium dasyphyllum* (13%).

Distribution: Major alpine habitat type of mesic uplands; commonly found throughout the alpine zone of the northern Colorado front range of the Rocky Mountains; primarily east of the continental divide.

11400 12800

Site Characteristics: Elevational Range -- 3,475m to 3,900m
Aspect Range -- southwest to easterly
Slope % Range -- 3% to 26%
Topographic Position -- gentle to moderate sloping upland terrain of non-northerly aspects; protected from direct exposure to prevailing winds, allowing some winter snow accumulation; more mesic than *CARU/TRDA* h.t. or *CARU/GERO* h.t.

Soil Characteristics: Moderately deep, loam to sandy loam, gravelly and cobbly soils; solum, 30cm to 50cm in depth, comprised of relatively dark A horizon (umbric) and frequently occurring cambic B horizon; coarse fragment content of the solum generally exceeds 30%. The A-horizon pH varies between 5.4 and 6.6. Parent material composed of igneous and metamorphic colluvium.

Soil Families: loamy-skeletal mixed Typic Cryumbrept
loamy-skeletal mixed Typic Cryorthent

Source Reference: Hess (1981).

Geographic Reference: Arapaho-Roosevelt National Forest.

Kobresia bellardi/Geum rossii h.t. (*KOBE/GERO* h.t.)

Plant Association: Dry alpine grassland dominated by a mixture of grass-like plants and forbs; principally among these are *Kobresia bellardi*, and *Geum rossii*. Species diversity and herbaceous cover low to moderate. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Calamagrostis purpurascens* (t), *Carex rupestris* (6%), *Danthonia intermedia* (t), *Festuca ovina brachyphylla* (t), *Kobresia bellardi* (45%), *Poa rupicola* (t), and *Trisetum spicatum* (t).

Forbs: *Artemisia scopulorum* (2%), *Gentiana algida* (1%), *Geum rossii* (14%), *Hymenoxys grandiflora* (t), *Mertensia viridis* (1%), *Oreoxis alpina* (2%), *Polygonum bistortoides* (3%), *Polygonum viviparum* (2%), *Potentilla diversifolia* (1%), *Trifolium* spp. (1%).

Distribution: Widely distributed, major grassland habitat type of the low to mid alpine; common on both sides of the continental divide in the north-central Colorado Rocky Mountains.

Site Characteristics: 11640 12800
Elevational Range -- 3,550m to 3,900m
Aspect Range -- variable; predominantly N.E. to N.W.
Slope % Range -- 1% to 30%
Topographic Position -- gentle to moderately sloping saddles and upper slope positions where exposure to prevailing winds maintain relatively snow-free surface during winter months; mesic environment equivalent to that of the *CAEL/GERO* h.t.

Soil Characteristics: Shallow to moderately deep, loam to sandy loam, variably gravelly and cobbly soils; solum, ranging in depth from 15cm to over 40cm, comprised of only an A horizon (Entisols) or umbric to mollic epipedon and a cambic B horizon; coarse fragment % of the solum frequently exceeds 25%. The A-horizon pH varies between 4.8 and 6.6. Igneous and metamorphic rock comprise the most common parent material.

Soil Families: loamy-skeletal mixed non-acid Typic Cryorthent
loamy-skeletal mixed Typic Cryoboroll
loamy-skeletal mixed Typic Cryumbrept
coarse loamy mixed Typic Cryumbrept

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

Andropogon gerardii/Andropogon scoparius h.t. (*ANGE/ANSC* h.t.)

Plant Association: Mesic grassland dominated by *Andropogon gerardii* in tall grass stratum and by *Andropogon scoparius* in the midgrass layer. A partial list of species with high constancy follows (% composition by weight in parentheses):

Shrub Stratum (minor) -- *Gutierrezia sarothrae* (3%) and *Artemisia frigida* (2%).

Herbaceous stratum

Graminoids: *Andropogon gerardii* (44%), *Andropogon scoparius* (4%), *Bouteloua curtipendula* (3%), and *Bouteloua gracilis* (2%).

Forbs: *Medicago* spp. (3%) and *Petalostemon* spp. (2%).

Distribution: Sand Creek Exclosure, Black Hills, South Dakota; very common habitat type in the midwestern true and tallgrass prairies; occurring westward on shallow "break" range sites and in small parks in lower elevation, east slope Central Rocky Mounatin ponderosa pine woodlands.

Site Characteristics: Elevational Range -- 1,372m (only one site)
Aspect Range -- west/southwest (only one site)
Slope % Range -- 0% (only one site)
Topographic Position -- Flat ridge (only one site)

Soil Characteristics: Shallow soils developed from limestone; only 20cm to Cca horizon. Surface soil mildly basic and medium textured. AC horizon silty loam in texture, very dark brown, calcareous, and moderately basic.

Soil Families: Information not available. Profile descriptions provided in reference.

Source Reference: Pase and Thilenius (1968); Terwilliger et al (1979), no. 160.

Geographic Reference: Sand Creek Exclosure, Black Hills National Forest.

Andropogon hallii/Calamovilfa longifolia h.t. (*ANHA/CALO* h.t.)

Plant Association: Sub-mesic sand prairie dominated by *Andropogon hallii* with *Calamovilfa longifolia* co-equal in cover but shorter with less above-ground biomass. Moderate species diversity. A partial list of species with high constancy follows (% canopy cover in parentheses):

Shrub Stratum (minor): *Rosa arkansana* (5%).
Herbaceous Stratum
Graminoids: *Calamovilfa longifolia* (24%), **Andropogon hallii* (14%), *Andropogon scoparius* (6%), *Eragrostis trichodes* (6%), *Sporobolus cryptandrus* (3%), *Bouteloua hirsuta* (5%).
Forbs: *Ambrosia psilostachya* (1%), *Petalostemon villosum* (1%).
*Excellent range condition for this habitat type would reveal approximately 25% *Andropogon hallii* and 20% *Calamovilfa longifolia* by weight in the 508mm to 610mm precipitation zone in Nebraska.

Distribution: A major habitat type found on steeper and higher dunes in the sandhills of Nebraska and elsewhere in the Central Great Plains.

Site Characteristics: Elevational Range -- 730m to 1,150m
Aspect Range -- variable
Slope % Range -- 20% to 40%
Topographic Position -- steep dune-like hills

Soil Characteristics: Regosols, weakly developed in deep aeolian sands; A horizon (5cm thick):dark grayish brown, sandy texture, single grain structure; C1 horizon (15cm - 23cm thick): brown, medium sand, single grain structure; C2 horizon (15cm-91cm thick): brown to pale brown, medium sand, single grain structure. Non-limey, non-mottled profile; pH at surface 6.4, pH in subsurface 6.7.

Soil Families: Information not available. See profile data in reference.

Source Reference: Burzlaff (1960; 1962); Terwilliger et al (1979), no. 208.

Geographic Reference: Nebraska National Forest (Cherry County).

Special Note: Vegetation data shown above is the culmative average of 24 stands (3 each in 8 counties) reported in Univ. Nebraska Agric. Exp. Stn. Res. Bull. 206. Soils information pertinent to Cherry County was abstracted from Burzlaff (1960).

Agropyron smithii/Bouteloua gracilis h.t. (*AGSM/BOGR* h.t.)

Plant Association: Dry grassland dominated by *Agropyron smithii*; *Bouteloua gracilis* dominates the lower grass stratum. Low diversity of forbs. A partial list of species with high constancy follows (% composition by weight in parentheses):

Shrub Stratum (minor) -- *Artemisia frigida* (no % weight data)
Herbaceous Stratum
Graminoids: *Bromus japonicus*[1] (45%), *Agropyron smithii* (25%), *Carex* spp. (10%), and *Bouteloua gracilis* (9%).
Forbs: *Artemisia dracunculus* (5%).

[1]Naturalized exotic; considered a self-perpetuating disclimax with the perennial species continuing to show relative order of dominance approximately as in climax. Grazing eliminates or greatly suppresses *Bromus japonicus*. This could be considered a rather poor quasi-climax by overlooking *Bromus japonicus* and taking into account the effect of grazing exclusion within the sampled exclosure.

Distribution: Robinson Flat Exclosure, Black Hills, South Dakota. Habitat type is widespread in mixed prairies of the northern Great Plains and southward along the east sloping foothills of the Rocky Mountains.

Site Characteristics: Elevational Range -- 1,280m (only one site)
Aspect Range -- southwest (only one site)
Slope % Range -- flat (only one site)
Topographic Position -- recorded but not published.

Soil Characteristics: Well developed soils derived from limestone with well expressed clay B horizons; clay loam surface horizon is light brownish gray, slightly acid with granular structure; subsoil dark grayish brown, slightly acid with angular blocky structure. The B2t horizon is dark brown, neutral and has prismatic structure. The C horizon is clayey, strongly basic, and has conspicuous calcareous deposits.

Soil Families: Information not available. Profile descriptions given.

Source Reference: Pase and Thilenius (1968); Terwilliger et al (1979), no. 157.

Geographic Reference: Robinson Flat Exclosure, Black Hills National Forest.

(ind. Chvi3/Agsp)

Agropyron spicatum/Poa sandbergii h.t. (*AGSP/POSA* h.t.)

Plant Association: Dry grassland dominated by a mixture of grass and grass-like species; principally among these are *Agropyron spicatum* and *Poa sandbergii*; species diversity and herbaceous cover very low. Shrub canopy represented by *Artemisia frigida* and *Chrysothamnus viscidiflorus*. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum -- *Artemisia frigida* (4%), *Chrysothamnus viscidiflorus* (12%).

Herbaceous Stratum

Graminoids: *Agropyron dasystachyum* (1%), *Agropyron spicatum* (12%), *Carex heliophila* (1%), *Koeleria cristata* (7%), *Poa sandbergii* (6%), and *Stipa comata* (2%).

Forbs: *Astragalus* spp. (t), *Arenaria fendleri* (2%), *Erigeron* spp. (t), *Oxytropis lambertii* (3%), *Penstemon* spp. (1%), and *Sedum stenopetalum* (1%).

Distribution: Minor grassland habitat type of xeric, windswept sites; locally abundant only on the White River Plateau and on exposed hilltops along the Laramie River in the northeastern Colordao Rocky Mountains; common at the interface of coniferous forest and shrub steppe.

8200 10000

Site Characteristics: Elevational Range -- 2,500m to 3,050m
Aspect Range -- variable
Slope % Range -- 2% to 20%
Topographic Position --sites occupy exposed, windswept ridges and knolls as well as gently sloping, upland terrain of principally northerly exposure; most xeric of the subalpine grasslands.

Soil Characteristics: Shallow to moderately deep, loam to sandy loam, very gravelly and cobbly soils; solum, varying in depth from 15cm to 30cm, comprised of skeletal A horizon (Entisols) or skeletal mollic epipedon with Lithic contact at approximately 30cm to 40cm below the soil surface; coarse fragment content of solum exceeds 35%; bare soil and exposed gravell and rock comprise over 50% of ground surface. The A-horizon pH ranges from 6.8 to 8.1. Interbedded sandstone and residual metamorphic rock comprise the most common parent material.

Soil Families: loamy-skeletal mixed Lithic Cryoboroll
loamy-skeletal mixed Lithic Cryorthent

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: White River and Roosevelt National Forests.

Dain/Podi

Danthonia intermedia/Erigeron simplex h.t. (*DAIN/ERSI* h.t.)

Plant Association: Subhumid, alpine, low grassland characterized by a dominance of *Danthonia intermedia* with *Erigeron simplex* a fairly consistent associate; moderately high species diversity and weakly moderate canopy coverage. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Danthonia intermedia* (30%), *Festuca brachyphylla* (1%), *Poa epilis* (1%), and *Trisetum specatum* (1%).

Forbs: *Erigeron simplex* (6%), *Solidago multiradiata* (5%), *Achillea lanulosa* (3%), *Potentilla diversifolia* (3%), *Pseudocymopteris montanus* (2%), *Polygonum bistortoides* (1%), and *Saxifraga rhomboides* (1%).

Distribution: Minor but locally abundant habitat type in the upper subalpine zone of the White River National Forest and southwestern Arapaho National Forest.

10820 11820

Site Characteristics: Elevational Range -- 3,300m to 3,600m
Aspect Range -- easterly to southwesterly
Slope % Range -- 2% to 48%
Topographic Position -- primarily on gently sloping upland benches and top slope positions of rolling terrain with southerly exposures.

Soil Characteristics: Well drained, shallow, permeable soils typically have a brown loam surface layer about 5 cm thick lying over a brown, very gravelly loam subsurface layer about 16 cm thick. Bedrock of sandstone, granite, or schist composition is encountered at a depth of approximately 28 cm. The pH of A horizon varies between 5.4 and 6.7. Coarse fragment content varies.

Soil Families: loamy-skeletal mixed Typic Cryoborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

Danthonia parryi/Carex heliophila h.t. (*DAPA/CAHE* h.t.)

Plant Association: Mesic grassland dominated exclusively by *Danthonia parryi*; *Carex heliophila* major secondary species; low diversity and canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Artemisia frigida* (1%)
Herbaceous Stratum
Graminoids: *Carex heliophila* (3%), *Danthonia parryi* (56%), *Koeleria cristata* (1%), *Muhlenbergia montana* (2%), and *Poa sandbergii* (1%).
Forbs: *Antennaria rosea* (2%), *Chrysopsis villosa* (1%), *Eriogonum umbellatum* (2%), *Gaillardia aristata* (t), *Mertensia lanceolata* (1%), *Penstemon secundiflorus* (t), and *Potentilla hippiana* (3%).

Distribution: A minor though widely distributed grassland habitat type of small to medium park-like openings in Ponderosa pine forests; common throughout the montane zone of the northern Colorado front range of the Rocky Mountains.

8030 8700

Site Characteristics: Elevational Range -- 2,450m to 2,650m
Aspect Range -- variable
Slope % Range -- 10% to 20%
Topographic Position -- gently sloping, upland terrain of flat to convex surface relief; generally found on exposed, non-northerly aspects.

Soil Characteristics: Deep, coarse-loamy to loamy soils; solum, commonly exceeding 60cm in depth, comprised of a mollic to pachic mollic epipedon and a cambic to argillic B horizon; coarse fragment content of solum is less than 20%. The A-horizon pH varies between 6.4 and 6.6. Common parent materials include alluvial and colluvial materials of gneiss and schist origins.

Soil Families: coarse-loamy mixed frigid Pachic Argiboroll
coarse-loamy mixed frigid Pachic Haploboroll
coarse-loamy mixed frigid Typic Argiboroll

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Deschampsia caespitosa/Geum rossii h.t. (*DECA/GERO* h.t.)

Plant Association: Mesic grassland dominated by *Deschampsia caespitosa*; *Geum rossii* principal secondary species; moderate diversity and canopy coverage among other associated species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Carex scopulorum* (2%), *Deschampsia caespitosa* (43%), *Festuca ovina brachyphylla* (1%), *Juncus drummondii* (1%), and *Trisetum spicatum* (1%).

Forbs: *Artemisia scopulorum* (3%), *Caltha leptosepala* (4%), *Castilleja occidentalis* (t), *Erigeron melanocephalus* (t), *Erigeron simplex* (1%), *Geum rossii* (14%), *Polygonum bistortoides* (3%), *Potentilla diversifolia* (2%), *Senecio* spp. (2%), *Sibbaldia procumbens* (4%), *Trifolium parryi* (5%), and *Veronica wormskjoldii* (t).

Distribution: Areally extensive and widely distributed habitat type of the low to mid alpine zone; occupies sites of moderate snow accumulation and persistence in the northern and central Colorado Rocky Mountains.

11480 12550

Site Characteristics: Elevational Range -- 3,500m to 3,825m
Aspect Range -- variable
Slope % Range -- 6% to 29%
Topographic Position -- gentle to moderately sloping upland landscape of variable surface relief; moderately protected terrain subject to intermediate persistent snow cover or lying below persistent snow fields; well-drained.

Soil Characteristics: Moderately deep, well drained, permeable silty loam to sandy loam soils; solum, varying between 35cm and 50cm in depth, comprised of an umbric to ochric epipedon and a cambic B horizon; coarse fragment content of solum highly variable (10% to over 40%). The A-horizon pH ranges from 4.8 to 6.2. Parent materials commonly of igneous and metamorphic rock origins.

Soil Families: loamy-skeletal mixed Typic Cryochrept
loamy-skeletal mixed (non acid) Cryorthent
coarse loamy mixed Pergelic Cryumbrept
loamy-skeletal mixed Pergelic Cryumbrept

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

Deschampsia caespitosa/Caltha leptosepala h.t. (*DECA/CALE* h.t.)

Plant Association: Wet grassland dominated by *Deschampsia caespitosa*; *Caltha leptosepala* principal secondary species; low diversity and canopy coverage among other associated species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Calamagrostis canadensis* (2%), *Carex aquatilis* (4%), *Carex rostrata* (1%), *Deschampsia caespitosa* (39%), *Phleum alpinum* (1%), and *Trisetum wolfii* (t).

Forbs: *Caltha leptosepala* (25%), *Epilobium* spp. (1%), *Galium* spp. (1%), *Pedicularis groenlandica* (1%), *Polygonum bistortoides* (2%), *Ranunculus alismaefolius* (6%), *Sedum rhodanthum* (t), and *Veronica wormskjoldii* (1%).

Distribution: Widely distributed, though minor, habitat type of poorly drained terrain in the White River, Roosevelt, and Arapaho National Forests; occurs in spruce-fir forest openings and across broadly expansive valley bottoms within the sub-alpine zone.

Site Characteristics: Elevational Range -- 2,900m (9510) to 3,350m (10990)
Aspect Range -- variable
Slope % Range -- 0% to 6%
Topographic Position -- level to near level terrain of variable exposure and flat to concave landscape relief; poorly drained, moisture accumulation and retention sites; either small openings in spruce-fir forests or broad subalpine valley bottoms.

Soil Characteristics: Moderately deep, mineral soils with high organic matter content; soils saturated to moist for much of growing season; solum, 30cm to 50cm in depth, comprised of mollic, umbric or histic epipedon and cambic B horizon; coarse fragment content of solum less than 5%. The A-horizon pH ranges from 5.2 to 7.0. Alluvial parent materials of mixed mineralogical origins common.

Soil Families: coarse loamy mixed Aquic Cryumbrept
coarse loamy mixed Typic Cryumbrept
coarse silty mixed Histic Cryaquept
fine mixed Typic Cryaquoll
fine mixed Typic Cryaquent
fine loamy mixed Typic Cryaquoll

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forest.

Festuca idahoensis/Agropyron trachycaulum h.t. (*FEID/AGTR* h.t.)

Plant Association: Mesic, high elevation grassland typified by a dominance of *Festuca idahoensis* in the herb layer with *Agropyron trachycaulum* the most typical associate; a very high species diversity and moderately high canopy coverage. A partial list of species of high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Festuca idahoensis* (31%), *Agropyron trachcaulum* (5%), *Carex raynoldsii* (3%), *Melica spectabilis* (1%), and *Bromus ciliatus* (t).

Forbs: *Achillea lanulosa* (7%), *Geum triflorum* (6%), *Potentilla gracilis* (7%), *Erigeron speciosus* (2%), *Senecio crassulus* (3%), and *Thlaspi alpestre* (2%).

Distribution: Minor grassland habitat type found primarily on the southwestern White River Plateau.

Site Characteristics: Elevational Range -- 2,925m to 3,000m
Aspect Range -- northerly
Slope % Range -- 4% to 12%
Topographic Position -- gently inclined mostly north facing, low slope positions frequently above more hydric grassland meadows or along broad early-seasonal drainages.

Soil Characteristics: Moderately deep, well drained, and moderately permeable soils typically have a brown loam surface layer about 13 cm thick and a brown loam subsoil about 30 cm thick over a yellowish, extremely cobbly clay loam substratum of mixed alluvial origin. Surface soil is slightly acid.

Soil Families: clayey-skeletal mixed Argic Pachic Cryoborolls; loamy-skeletal mixed Pachic Cryoborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Festuca idahoensis/Geranium nervosum h.t. (*FEID/GENE* h.t.)

Plant Association: Submesic, high elevation grasslands characterized by a dominance of *Festuca idahoensis* in the herb layer with *Geranium nervosum* the more prominent secondary associate; high species diversity, and a moderately high canopy coverage of herbs. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Festuca idahoensis* (26%), *Stipa lettermannii* (2%), *Agropyron trachycaulum* (2%), and *Melica spectabilis* (1%).

Forbs: *Geranium nervosum* (15%), *Potentilla gracilis* (11%), *Erigeron speciosus* (4%), *Achillea lanulosa* (2%), *Agoseris glauca* (1%), and *Helenium hoopesii* (2%).

Distribution: Locally abundant grassland habitat type found chiefly across the southern White River Plateau.

Site Characteristics: Elevational Range -- 2,850m to 2,950m
Aspect Range -- variable
Slope % Range -- 2% to 7%
Topographic Position -- on upland ridges and top slope positions of gentle inclination and variable exposure.

Soil Characteristics: Deep, well drained, moderately permeable soils typified by having a dark grayish brown silt loam surface layer about 8 cm thick and a dark grayish brown, silt loam subsoil about 25 cm thick over a dark brown, very cobbly clay substratum of either sandstone, limestone, or dolomite origin. Cobbly clay substratum appears to restrict vegetation to somewhat shallower rooted grasses. Surface layer is slightly acid.

Soil Families: clayey-skeletal mixed and fine mixed Typic Cryoborolls; loamy-skeletal mixed Cumulic Cryoborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Festuca thurberi/Festuca idahoensis h.t. (*FETH/FEID* h.t.)

Plant Association: Mesic grassland dominated exclusively by *Festuca thurberi*; *Festuca idahoensis* major secondary species; moderate species diversity yet low canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Agropyron trachycaulum* (1%), *Bromus ciliatus* (1%), *Carex* spp. (2%), *Festuca idahoensis* (7%), *Festuca thurberi* (34%), *Melica spectabilis* (t), and *Stipa lettermanii* (1%).

Forbs: *Achillea lanulosa* (9%), *Agoseris glauca* (1%), *Collomia linearis* (t), *Helenium hoopesii* (2%), *Lathyrus leucanthus* (cover data merged with *Vicia americana*), *Polygonum douglasii* (2%), *Potentilla gracilis* (4%), *Solidago multiradiata* (7%), *Vicia americana* (2%), and *Viola nuttallii* (t).

Distribution: A major grassland habitat type of the northcentral Colorado Rocky Mountains; non-southerly exposed, gently sloping to rolling hillsides and well drained swales of the lower subalpine zone.

9180 9760

Site Characteristics: Elevational Range -- 2,800m to 2,975m
Aspect Range -- west, north, and easterly
Slope % Range -- 4% to 16%
Topographic Position -- level to gently sloping upland terrain; favorable topographic position minimizes exposure to prevailing winds and maximizes winter snow accumulation in comparison to the *FEID/GENE* h.t.; surface relief generally variable.

Soil Characteristics: Deep, well drained and moderately permeable, loamy soils; solum, commonly exceeding 75cm in depth, comprised of a pachic mollic epipedon and a distinct cambic B horizon; coarse fragment content of the solum generally less than 15%. The A-horizon pH varies from 6.1 to 7.0. Parent materials are of mixed sedimentary origins.

Soil Families: fine loamy mixed Cumulic Cryoboroll
loamy-skeletal mixed Cumulic Cryoboroll
coarse loamy mixed Cumulic Cryoboroll
fine loamy over clayey mixed Cumulic Cryoboroll

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River and Arapaho National Forests.

Festuca thurberi/Vicia americana-Lathyrus leucanthus h.t. (*FETH/VIAM-LALE* h.t.)

Plant Association: Mesic grassland dominated exclusively by *Festuca thurberi*; *Vicia americana* and *Lathyrus leucanthus* principal secondary species; moderate diversity and low canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Agropyron trachycaulum* (3%), *Bromus ciliatus* (2%), *Carex* spp. (3%), *Festuca thurberi* (50%), *Stipa columbiana* (t), and *Stipa lettermanii* (1%).

Forbs: *Achillea lanulosa* (4%), *Castilleja septentrionalis* (1%), *Erigeron speciosus* (3%), *Helenium hoopesii* (2%), *Lathyrus leucanthus* (cover data merged with *Vicia americana*), *Potentilla gracilis* (1%), *Solidago multiradiata* (3%), and *Vicia americana* (7%).

Distribution: A major grassland habitat type on high elevation lands in the Arapaho and White River National Forests; occurs in park openings of spruce-fir forests and across broad expanses of exposed, level to rolling terrain.

Site Characteristics: Elevational Range -- 2,925m to 3,300m
9590 10830
Aspect Range -- southeastern to southwestern
Slope % Range -- 3% to 54%
Topographic Position -- gentle to moderately sloping dry hillsides and broadly expansive rolling uplands; frequently present in park openings of spruce-fir forests; maximum development on White River Plateau where sites characteristically exposed to desiccating winds and intense solar radiation.

Soil Characteristics: Very deep, well drained, moderately permeable loamy soils; solum , commonly exceeding 75cm in depth, comprised of a pachic mollic epipedon and a distinct cambic B horizon; coarse fragment content of solum is less than 10% in most cases. The A-horizon pH varies between 5.9 and 6.6. Common parent materials of mixed sedimentary origins.

Soil Families: coarse loamy mixed Calcic Pachic Cryoboroll
fine loamy mixed Pachic Cryoboroll
loamy-skeletal mixed Cumulic Cryoboroll
coarse loamy mixed Cumulic Cryoboroll
fine loamy over sandy-skeletal mixed Cumulic Cryoboroll
fine loamy mixed Cumulic Cryoboroll

Source Reference: Hess (1981), and Hess and Wasser (1982).

Geographic Reference: Arapaho and White River National Forests.

Anha/Calo

Calamovilfa longifolia/Andropogon hallii h.t. (*CALO/ANHA* h.t.)

Plant Association: Semi-arid sand prairie dominated by *Calamovilfa longifolia*; *Andropogon hallii* secondary in terms of cover and herbage production. Moderate species diversity. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Rosa arkansana* (1%) and *Amorpha canescens* (3%).
Herbaceous Stratum
Graminoids: *Calamovilfa longifolia* (28%), *Andropogon hallii* (11%), *Andropogon scoparius* (3%), *Sporobolus cryptandrus* (9%), and *Bouteloua hirsuta* (7%).
Forbs: *Ambrosia psilostachya* (3%).

Distribution: Major habitat type that occurs extensively on the rolling sandhills of the Central Great Plains.

2390 3780

Site Characteristics: Elevational Range -- 730m to 1,150m
Aspect Range -- variable
Slope % Range -- 4% to 8%
Topographic Position -- gently undulating hills and valleys in the sandhills region; topography exhibits maximum of 24m to 30m change in relief.

Soil Characteristics: Regosols, exhibiting weak to moderately weak horizonation on aeolian sand parent material. Surface soil is dark grayish brown, fine sand to loamy fine sand of weak, fine crumb structure. AC horizon (10cm to 41cm in depth): dark brown to dark grayish brown, fine sand of single grain structure. C1 and C2 horizons: brown, grayish brown and dark brown fine sand to sand. Soils are non-calcareous; no evidence of mottling due to high water table. Subsoils very loose. Soil pH neutral to very slightly acid at all depths.

Soil Families: Information not available. See profile data in reference.

Source Reference: Burzlaff (1960; 1962). Also see Special Note for the *ANHA/CALO* h.t.

Geographic Reference: Nebraska National Forest (Cherry County).

Calamovilfa longifolia/Bouteloua gracilis h.t. (*CALO/BOGR* h.t.)

Plant Association: Semi-arid, mixed sand prairie with *Calamovilfa longifolia* dominating upper herbaceous layer and *Bouteloua gracilis* dominating lower herbaceous stratum. Moderate species diversity. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Amorpha canescens* (3%) and *Rosa arkansana* (1%).
Herbaceous Stratum
Graminoids: *Calamovilfa longifolia* (21%), *Andropogon hallii* (5%), *Sporobolus cryptandrus* (6%), and *Bouteloua gracilis* (13%).
Forbs: *Ambrosia psilostachya* (3%).

Distribution: Widely distributed, major habitat type occurring in valleys, on the base of dune slopes, and on level sand plains in the Central Great Plains.

Site Characteristics: Elevational Range -- 730m to 1,150m
Aspect Range -- variable
Slope % Range -- near level
Topographic Position -- level valleys between dunes in the sandhills region.

Soil Characteristics: Moderate soil development derived from aeolian sand parent material. Surface soils are fine sands to loamy fine sands, very dark grayish brown, with single grain structure; some surface graying due to abundant roots in the top 40cm. Subsoil extends to 100cm+; mostly medium sand textured with loose, single grain structure. Entire profile non-effervescent and non-mottling. Surface soil slightly acid; subsoil nearly neutral.

Soil Families: Information not available. See profile data in reference.

Source Reference: Burzlaff (1960; 1962). Also see Special Note for the *ANHA/CALO* h.t.

Geographic Reference: Nebraska National Forest (Cherry County).

Bouteloua gracilis/Agropyron smithii h.t. (*BOGR/AGSM* h.t.)

Plant Association: Dry grassland dominated by *Bouteloua gracilis* with midgrasses secondary in production and composition. Rather low species diversity and moderate herbaceous cover. A partial list of species with high constancy follows (% composition by weight in parentheses):

Herbaceous Stratum

Graminoids: *Bouteloua gracilis* (43%), *Agropyron smithii* (23%), *Stipa comata* (8%), and *Koeleria cristata* (6%).

Forbs: *Artemisia dracunculus* (8%).

Distribution: Minor habitat type; a foothill variation of the more common *Bouteloua gracilis-Buchloe dactyloides/Agropyron smithii* h.t. or the *Bouteloua gracilis-Buchloe dactyloides/Stipa comata* h.t. found on finer and coarser, respectively, northern and central Great Plains mixed prairie rangelands.

Site Characteristics: Elevational Range -- 1,372m (one site)
Aspect Range -- northeast (one site)
Slope % Range -- sloping; percent recorded but not published
Topographic Position -- recorded but not published

Soil Characteristics: Soils derived from calcareous sandstone; soils are shallow, extending only 45cm to hard, dry, and impervious C horizon. Surface soil silty clay loam, moderately acid to almost neutral with granular structure; subsoil is clay loam, dark grayish brown to dark yellowish brown, with fine subangular blocky structure. AC horizon is stony, silt loam, mildly basic, with subangular blocky structure.

Soil Families: Information not available. See reference for detailed soil profile descriptions.

Source Reference: Pase and Thilenius (1968); Terwilliger et al (1979), revised no. 162.

Geographic Reference: North Pilger Exclosure, Black Hills National Forest.

Elymus ambiguus/Ribes cereum h.t. (*ELAM/RICE* h.t.)

Plant Association: A physiognomically variable and weakly expressed grassland dominated by *Elymus ambiguus*; higher order strata represented principally by *Ribes cereum*; low diversity and canopy coverage among the remaining components of all strata delineates this type as a grassland despite the presence of trees and shrubs. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Tree Stratum (minor) -- *Juniperus scopulorum, Pinus ponderosa,* and *Pseudotsuga menziesii* (no cover data for trees).
Shrub Stratum -- *Artemisia frigida* (2%), *Chrysothamnus nauseosus* (4%), *Ribes cereum* (8%), and *Rubus deliciosus* (3%).
Herbaceous Stratum
Graminoids: *Bouteloua gracilis* (5%), and *Elymus ambiguus* (15%).
Forbs: *Artemisia ludoviciana* (2%), *Chrysopsis villosa* (1%), *Cryptantha virgata* (t), and *Phacelia heterophylla* (1%).

Distribution: A minor grassland habitat type occupying steep canyon walls and talus slopes at lower elvations along the northern Colorado front range of the Rocky Mountains.

Site Characteristics: 5900 7220
Elevational Range -- 1,800m to 2,200m
Aspect Range -- variable
Slope % Range -- 70% to 90%
Topographic Position -- very steep to nearly vertical canyon walls and talus slopes; occupying small ledges and rock fractures where soil formation and accumulation has occurred.

Soil Characteristics: Shallow, sandy loam to loamy sand soils with lithic contact within 30cm of the surface, except on tallus slopes; solum consists only of a highly skeletal A horizon; C horizon extremely cobbly. The A-horizon pH varies between 6.2 and 6.4. Common parent materials include residual and colluvial granite, gneiss, and schist rock.

Soil Families: loamy skeletal mixed frigid Lithic Ustorthent
loamy skeletal mixed frigid Typic Ustorthent

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Stipa comata/Muhlenbergia montana h.t. (*STCO/MUMO* h.t.)

Plant Association: Dry grassland dominated by a mixture of midgrasses (principally, *Stipa comata*) and shortgrasses (principally, *Muhlenbergia montana*); moderate diversity and canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Artemisia frigida* (5%), *Leptodactylon pungens* (t), and *Pediocactus simpsonii* (t).

Herbaceous Stratum

Graminoids: *Agropyron griffithsii* (1%), *Agropyron smithii* (3%), *Carex eleocharis* (2%), *Koeleria cristata* (2%), *Muhlenbergia filiculmis* (2%), *Muhlenbergia montana* (11%), *Poa sandbergii* (3%), and *Stipa comata* (22%).

Forbs: *Allium geyeri* (t), *Antennaria rosea* (4%), *Arenaria fendleri* (1%), *Harbouria trachypleura* (2%), *Mertensia lanceolata* (t), *Oxytropis lambertii* (1%), and *Penstemon secundiflorus* (t).

Distribution: A minor grassland habitat type of xeric forest openings and occasionally extensive rolling parklands in the ponderosa pine zone of the northern Colorado front range of the Rocky Mountains.

Site Characteristics: Elevational Range -- 2,375m to 2,550m
Aspect Range -- southeasterly to southwesterly
Slope % Range -- 15% to 25%
Topographic Position -- moderately inclined, upland slopes and ridge tops; xeric sites of mostly convex to flat surface relief.

Soil Characteristics: Moderately deep, sandy loam soils; solum, varying between 43cm and 66cm in depth, comprised of a weakly expressed mollic epipedon and a distinct argillic B horizon; coarse fragment content of the solum varies from 35% to 55%. The A-horizon pH ranges from 6.2 to 6.8. Common parent materials include colluvium of granitic and gneiss origins.

Soil Families: loamy-skeletal mixed frigid Typic Argiboroll

Source Reference: Hess (1981).

Geographic Location: Roosevelt National Forest.

Stipa comata/Bouteloua gracilis h.t. (*STCO/BOGR* h.t.) (A)

Plant Association: Dry grassland dominated by a mixture of midgrasses (principally, *Stipa comata*) and shortgrasses (principally, *Bouteloua gracilis*); moderate diversity and canopy coverage among other associated species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Artemisia frigida* (5%), and *Pediocactus simpsonii* (t).

Herbaceous Stratum

Graminoids: *Agropyron smithii* (5%), *Bouteloua gracilis* (11%), *Carex heliophila* (2%), *Koeleria cristata* (2%), *Poa sandbergii* (t), and *Stipa comata* (25%).

Forbs: *Allium textile* (t), *Antennaria rosea* (1%), *Chrysopsis villosa* (2%), *Eriogonum umbellatum* (1%), *Euphorbia robusta* (t), *Leucocrinum montanum* (t), and *Senecio fendleri* (t).

Distribution: A widely distributed grassland habitat type of the foothills and lower montane zone of the northern Colorado front range of the Rocky Mountains.

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Site Characteristics: Elevational Range -- 1750m to 2,350m
Aspect Range -- variable
Slope % Range -- 0% to 25%
Topographic Position -- level to gently sloping river terraces and alluvial fans at lower elevations, and xeric forest openings of southerly exposures at higher elevations; surface relief of landscape variable.

Soil Characteristics: Moderate (high elevation) to deep (low elevation), coarse-loamy to sandy loam soils; solum, varying between 46 cm and 98 cm in depth, comprised of a mollic epipedon and a cambic to argillic B horizon; coarse fragment content of solum is less than 15%. The A-horizon pH varies from 7.0 to 7.6. Calcium carbonate accumulations common below 60cm. Common parent materials include alluvial and colluvial materials of granitic, gneiss, and schist origins.

Soil Families: coarse-loamy mixed mesic Typic Haplustoll
coarse-loamy mixed frigid Fluventic Haploboroll
coarse-loamy mixed frigid Typic Argiboroll

Source Reference: Hess (1981).

Geographic Reference: Roosevelt National Forest.

Special Note: See *STCO/BOGR* h.t. (B) on following page.

Stipa comata/Bouteloua gracilis h.t. (*STCO/BOGR* h.t.) (B)

Plant Association: Dry mixed prairie grassland dominated by *Stipa comata* with *Bouteloua gracilis* and *Carex* spp. dominating the lower grass stratum; species diversity low. Composition percentage by weight shown below for more common species:

Shrub Stratum (minor) -- *Artemisia frigida* (6%) and *Gutierrezia sarothrae* (1%).

Herbaceous Stratum

Graminoids: *Stipa comata* (29%), *Carex* spp. (19%), and *Bouteloua gracilis* (14%).

Forbs: Referred to only as *others* (16%).

Distribution: Pass Creek Range Exclosure in southern Black Hills, S.D.; association and habitat type common throughout northern and central Great Plains on silty to sandy loam soils of upland plains sites. Site in 432mm annual precipitation zone.

Site Characteristics: Elevation -- 1,402m
Aspect -- N.E.
Slope -- 0%
Topographic Position -- Flat

Soil Characteristics: Soils are shallow, only 23cm to Cca horizon; developed from limestone. The solum is stony throughout. The surface A1 horizon is 7.5cm to 13cm thick, calcareous, medium textured, and moderately basic. The AC horizon is 10cm thick, silt loam in texture, very dark brown and moderately basic in reaction.

Soil Families: Information not available

Source Reference: Pase and Thilenius (1968); Terwilliger et al (1979), no. 188 revised.

Geographic Reference: Pass Creek Range Exclosure, Black Hills National Forest.

Special Note: This habitat type appears to be very similar to the *STCO/BOGR* h.t. described in the Roosevelt National Forest. Although they may properly be grouped in the same habitat type, they have been separated in this review on the basis of different soils and extremely different environments.

Poa nervosa/Stipa lettermannii h.t. (*PONE/STLE* h.t.)

Plant Association: Mesic, high subalpine grasslands characterized by dominance of *Poa nervosa* and near-codominance of *Stipa lettermannii*; high species diversity and relatively high canopy coverage. A partial list of species of high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Poa nervosa* (15%), *Stipa lettermannii* (11%), *Poa epilis* (8%), *Deschampsia caespitosa* (4%), *Phleum alpinum* (3%), *Festuca ovina* (2%), and *Trisetum spicatum* (1%).

Forbs: *Achillea lanulosa* (8%), *Senecio crocata* (7%), *Erigeron peregrinus* (5%), *Solidago multiradiata* (5%), *Viola nuttallii* (5%), *Erigeron simplex* (4%), and *Thlaspi alpestre* (3%).

Distribution: Minor habitat type occupying a narrow altitudinal zone in the southeastern and southcentral White River Plateau.

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Site Characteristics: Elevational Range -- 3,250m to 3,450m
Aspect Range -- southerly and westerly
Slope % Range -- 6% to 14%
Topographic Position -- mostly southerly exposures and toe slopes with concave landscape relief and with favorable soil moisture relations resulting from topographic influence on snow accumulation and moisture runoff retention.

Soil Characteristics: Soils are deep, well drained and moderately permeable. Typically, the surface layer is brown, gravelly loam approximately 8 cm thick. The subsurface is comprised of two layers, a brown, gravelly loam approximately 30 cm thick and a brown, gravelly loam about 18 cm thick. The substratum is dark, yellowish brown, extremely gravelly sandy loam of mostly sandstone origin. Coarse fragment content is fairly low and the pH of the A horizon is 5.9 to 6.7.

Soil Families: loamy-skeletal mixed Typic Cryoborolls; fine-loamy mixed Cumulic Cryoboroll; and fine-loamy mixed Lithic Cryochrept.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Geum rossii/Polygonum bistortoides h.t. (*GERO/POBI* h.t.)

Plant Association: Mesic alpine forbland dominated primarily by a mixture of low growing forbs; principally among these are *Geum rossii*, *Polygonum bistortoides*, and *Artemisia scopulorum*. Low species diversity and moderate herbaceous cover. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Shrub Stratum (minor) -- *Salix arctica* (2%).
Herbaceous Stratum
Graminoids: *Deschampsia caespitosa* (3%), *Festuca ovina brachyphylla* (1%), and *Carex scopulorum* (3%).
Forbs: *Artemisia scopulorum* (8%), *Caltha leptosepala* (3%), *Geum rossii* (51%), *Polygonum bistortoides* (14%), and *Trifolium parryi* (6%).

Distribution: Major forbland habitat type of the low to mid alpine; commonly found on protected, mesic upland sites throughout the alpine zone of the north-central Rocky Mountains; equally distributed on both sides of the continental divide.

Site Characteristics: Elevational Range -- 3,575m to 4,000m
Aspect Range -- variable
Slope % Range -- 6% to 40%
Topographic Position -- occupies relatively protected, gentle to moderately inclined, mid to upper slope positions of mostly flat to concave surface relief. Commonly found adjacent to the more mesic *DECA/GERO* h.t. on more level or topographically lower terrain. Exhibits moderate winter snow accumulation.

Soil Characteristics: Moderately deep, well drained, silty loam to sandy loam, gravelly and cobbly soils; solum, 25cm to 55cm deep, comprised of moderately developed A horizon (Entisol) to well expressed umbric epipedon overlying a distinct cambic B horizon (Inceptisol and Mollisol); coarse fragment content of solum varies from 15% to over 50%. The A-horizon pH ranges between 4.6 and 5.2. Igneous and metamorphic rock comprise the most common parent material.

Soil Families: loamy-skeletal mixed acid Typic Cryorthent
loamy-skeletal mixed Pachic Cryoboroll
coarse loamy mixed Typic Cryumbrept

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

= Lipo/Viam

Ligusticum porteri/Vicia americana-Lathyrus leucanthus h.t.
(*LIPO/VIAM-LALE* h.t.)

Plant Association: Hypermesic subalpine herbland typically dominated by *Ligusticum porteri* in the upper stratum with either or both *Vicia americana* and *Lathyrus leucanthus* as prominent associates; and shows a high degree of species diversity and canopy coverage, particularly of forbs. A partial list of species of high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Agropyron trachycaulum* (3%), *Festuca thurberi* (3%), *Melica spectabilis* (1%), and *Bromus marginatus* (t).

Forbs: *Ligusticum porteri* (38%), *Geranium nervosum* (9%), *Lathyrus leucanthus* and *Vicia americana* combined (7%), *Helianthella quinquenervis* (5%), *Achillea lanulosa* (4%), and *Erigeron speciosus* (2%).

Distribution: Minor habitat type found chiefly in the southcentral and eastern portions of the White River Plateau closely associated with the *FETH/VIAM-LALE* h.t.

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Site Characteristics: Elevational Range -- 2,900m to 3,200m
Aspect Range -- variable
Slope % Range -- 11% to 24%
Topographic Position -- in swales on landscape depressions, and on sheltered land areas where either winter snow accumulates or where moist soil conditions prevail throughout much of the growing season due to subsurface seepage.

Soil Characteristics: The moderately deep, well drained, and only moderately slowly permeable soils typically have a brown gravelly loam surface soil layer about 20 cm thick and a brown, gravelly clay loam subsoil about 56 cm thick lying over a brownish yellow clay substratum of shale and sandstone origin. Surface layer is acid (pH 5.8 - 6.6).

Soil Families: fine mixed Argic Pachic Cryoborolls;
fine-loamy mixed Argic Pachic Cryoborolls.

Source Reference: Hess and Wasser (1982).

Geographic Reference: White River National Forest.

Trifolium nanum/Paronychia pulvinata h.t. (*TRNA/PAPU* h.t.)

Plant Association: Xeric forbland dominated by variety of cushion plants; principally among these are *Trifolium nanum*, *Paronychia pulvinata*, and *Arenaria obtusiloba*; low species diversity and moderate canopy coverage among other associated herbaceous species. A partial list of species with high constancy follows (% canopy coverage in parentheses):

Herbaceous Stratum

Graminoids: *Carex rupestris* (2%), *Festuca ovina brachyphylla* (1%), *Luzula spicata* (t), *Poa rupicola* (t).

Forbs: *Arenaria fendleri* (1%), *Arenaria obtusiloba* (5%), *Artemisia* spp. (t), *Eritrichium elongatum* (t), *Geum rossii* (2%), *Haplopappus pygmaeus* (1%), *Paronychia pulvinata* (9%), *Silene acaulis* (2%), *Trifolium nanum* (18%).

Distribution: Widely distributed alpine habitat type; low to high alpine on exposed, windswept, rocky sites; common throughout the alpine zone of the north-central Colorado Rocky Mountain region.

Site Characteristics: Elevational Range -- 3,500m to 4,250m (11480 13950)
Aspect Range -- variable; N.E. to N.W. most common
Slope % Range -- 8% to 26%
Topographic Position -- commonly found on snow-free, windswept ridges and very exposed, upper slope positions; areas subject to desiccating and scouring effect of very strong seasonal winds; convex surface relief.

Soil Characteristics: Shallow, sandy loam to loamy sand, very gravelly and cobbly soils; solum, consisting only of a thin A horizon (4cm - 12cm), and thin, skeletal C horizon overlie consolidated bedrock of igneous and metamorphic origin at 20cm to 40cm; coarse fragment content of solum exceeds 40%. The A-horizon pH varies between 4.8 and 5.0. The ground surface has a very high percent cover of gravel and rock (exceeding 45%).

Soil Families: loamy-skeletal mixed Lithic Cryorthent
sandy-skeletal mixed Lithic Cryorthent
sandy-skeletal mixed Typic Cryorthent

Source Reference: Hess (1981) and Hess and Wasser (1982).

Geographic Reference: Arapaho, Roosevelt, and White River National Forests.

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APPENDIX

APPENDIX A

GLOSSARY

Abundant When relating to plant coverage in the habitat type key and description, any species having a canopy coverage of 25 percent or more in a stand.

Association All stands of climax vegetation that have the same overstory and understory dominants; the climax plant community type.

Basal area The area of the cross-section of a tree trunk at 4.5 feet above the ground, usually expressed as the sum of tree basal areas in square feet per acre.

Bench, benchland An area having flat or gently-sloping terrain (less than 15 percent slope), applied usually to the higher ground in a river valley.

Canopy coverage The area covered by the gross outline of an individual plant's foliage, or collectively covered by all individuals of a species within a stand or sample plot. Canopy coverage is expressed as a percentage of the total area in the plot, or as a canopy coverage class.

Climax community A relatively stable stage in plant succession for a given environment, that develops and tends to perpetuate itself in the absence of disturbance or environmental change.

Climax species A species that is self-regenerating in the absence of disturbance, with no evidence of replacement by other species.

Climax, types of -- in relation to environment (polyclimax concept):

Climatic climax A climax that characterizes normal topography (gently sloping) and soils (well-drained, medium textured), and shows no dependency for its character upon the maintenance of recurrent disturbance.

Edaphic climax A climax produced by substrata peculiarities and differing from the climatic climax of the area.

Topographic climax A variation from the climatic climax caused by topography that markedly influences microclimate.

Topo-edaphic climax A variation from the climatic climax caused by the combination of topographic and edaphic effects.

Codominant Two or more species that have nearly equal abundance or canopy cover either in the same or different stratum(s).

Common When relating to plant coverage in the habitat type key and description, any species having a canopy coverage of 1 percent or more in a stand.

Community (plant community) An assemblage of plants living together, reflecting no particular ecological status.

Constancy The percentage of stands in a habitat type that contains a given species.

d.b.h. (diameter at breast height) Tree-trunk diameter at 4.5 feet above the ground.

Depauperate Describing an unusually sparse coverage of undergrowth vegetation. This condition usually develops beneath an especially dense forest canopy, often on sites having a deep layer of duff.

Dominant The chief constituent of a plant association usually based on canopy cover, abundance, or aspect.

Ecosystem Any community of organisms along with its environment, forming an interacting system.

Ecotone The boundary or transition zone between adjacent plant communities, often representing different habitat types.

Edaphic Refers to soil.

Floodplain The nearly level land forming the bottom of a valley in which a stream is present and usually subject to flooding.

Forb An herbaceous plant that is not a graminoid.

Frequency The percentage of quadrats (microplots) in a single sample stand that contains a given species, or, more generally, the degree of uniformity with which individuals of a species are distributed in a stand.

Graminoid All grasses (*Gramineae*) and grass-like plants, including sedges (*Carex* spp.) and rushes (*Juncus* spp.)

Habitat type The aggregate of all areas that support, or can support, the same primary climax vegetation and which delineate an environment of distinctive potentialities as to pristine and derived types of communities.

Indicator plant A plant whose presence or abundance indicates the presence of certain environmental conditions -- presence of a habitat type or phase.

Phase A subdivision of an association and a habitat type representing minor though ecologically significant differences in climax vegetation and environmental conditions, respectively.

Poorly represented When relating to plant coverage in the habitat type key and description, any species that is absent or has a canopy coverage of less than 5 percent.

Present When relating to plant coverage in the habitat type key and description, any species that has a canopy coverage greater than zero and is not restricted to an obvious microsite.

Riparian Vegetation bordering watercourses, lakes or swamps.

Seral A species or community that is replaced by another species or community as succession progresses.

Series A group of habitat types having the same dominant climax species in the overstory synusia.

Site index An index of timberland productivity based upon the height of specific trees at a certain reference age (usually 50 or 100 years).

Stand A plant community that is relatively uniform in composition, structure, and habitat conditions; thus it may serve as a local example of an association or habitat type.

Stratum (synonym, layer; pl. strata) Pertains to the physiognomy or structure of vegetation which often has different layers of tall trees, low (dwarf) trees, tall shrubs, low shrubs, etc.

Subdominant Species which have less canopy cover, abundance, or aspect (visual impressions or estimation) than a dominant; often the dominant of lesser stratum.

Succesccion The omnidirectional changes in plant communities toward climax.

Terrace Flat or undulating land usually with a steep face bordering a stream or river.

Understory (synonym, undercover) Usually refers to the vegetation layers or dominants found below the uppermost layer or overstory, e.g., shrubs or shrub species under the dominant tree layer or dominant tree species.

Well represented When relating to plant coverage in the habitat type key and description, any species having a canopy coverage of greater than 5 percent.